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U.S. Army Corps of Engineers
New England District

FINAL
REMEDIAL INVESTIGATION REPORT
AREA OF CONTAMINATION (AOC) 57

VOLUME III OF III
APPENDICES E
THROUGH Q

CONTRACT DACA-31-94-D-0061
DELIVERY ORDER NUMBER 0001

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

JUNE 2000

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Harding
Lawson
Associates

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Prepared for:

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts

Prepared by:

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Portland, ME
Project No. 45001
Task No. 0914403

June 2000

AOC 57 AND LOWER COLD SPRING BROOK HISTORICAL SURFACE WATER AND SEDIMENT ANALYTICAL DATA

STORM DRAIN SYSTEMS NO. 1/2 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

	DITCH SAMPLE LOCATIONS			COLD SPRING BROOK SAMPLE LOCATIONS			
				UPSTREAM	DOWNSTREAM		
	SSD-93-01B 08/17/93 0 FT	CSD-94-29X 09/21/94 0 FT	CSD-94-30X 09/21/94 0 FT	CSD-94-31X 09/21/94 0 FT	CSD-94-32X 09/21/94 0 FT	CSD-94-33X 09/21/94 0 FT	CSD-94-34X 09/21/94 0 FT
PAL METALS ($\mu g/g$)							
Aluminum	9620	9430	7700	16700	5010	9320	5790
Arsenic	15.5	16	23.3	14.6	11.4	5.87	25
Barium	27.1	32.4	33.2	91.2	39.8	60.4	42.7
Beryllium	ND	ND	ND	< 0.5	< 0.5	< 0.5	< 0.5
Cadmium	< 1.2	1.63	< 0.7	ND	ND	ND	ND
Calcium	819	820	2470	3260	2410	1600	2340
Chromium	24.5	32.2	15.9	34.9	11.7	20.7	< 4.05
Cobalt	4.7	5.99	6.54	8.04	5.66	4.87	9.94
Copper	44.5	46.7	15.9	6.39	6.86	3.17	13.9
Iron	16700	13000	10400	12300	6770	7300	9740
Lead	44	78.7	43	15.5	23.5	6.92	52
Magnesium	4470	4590	2220	3500	1430	2410	1710
Manganese	203	259	277	759	891	597	358
Mercury	0.192	< 0.05	< 0.05	ND	ND	ND	ND
Nickel	18	24.5	15.6	25	10.4	14.3	15.7
Potassium	1700	1400	641	577	< 100	355	< 100
Selenium	ND	ND	ND	1.27	0.9	0.993	1.44
Sodium	76.6	519	1000	1330	891	796	1300
Vanadium	18.4	21.7	18.5	15.2	< 3.39	8.74	14.5
Zinc	62.9	53.9	83.5	33.2	39.7	20.3	83.6
PAL SEMIVOLATILE ORGANICS ($\mu g/g$)							
2-methylnaphthalene	0.21	< 22	< 1	ND	ND	ND	ND
9h-carbazole	ND	ND	ND	.1ND R	1ND R	.1ND R	1ND R
Acenaphthylene	5.8	< 2	< 0.7	< 0.033	< 0.3	< 0.033	< 0.3
Anthracene	7.1	< 2	< 0.7	0.33	< 0.3	< 0.033	< 0.3
Benzo [a] Anthracene	16	< 8	< 3	< 0.17	< 2	< 0.17	< 2
Benzo [a] Pyrene	8.4	< 10	< 5	< 0.25	< 2	< 0.25	< 2
Benzo [b] Fluoranthene	11	< 10	< 4	< 0.21	< 2	< 0.21	< 2
Benzo [g,h,i] Perylene	11	< 10	< 5	< 0.25	< 2	< 0.25	< 2
Benzo [k] Fluoranthene	6.3	< 30	< 1	< 0.066	< 0.7	< 0.066	< 0.7
Bis(2-ethylhexyl) Phthalate	ND	ND	ND	< 0.62	< 6	< 0.62	< 6
Chrysene	14	10	< 2	< 0.12	< 1	< 0.12	< 1
Fluoranthene	30	10	6	0.62	2	< 0.068	3
Fluorene	2.3	< 2	< 0.7	< 0.033	< 0.3	< 0.033	< 0.3
Indeno [1,2,3-c,d] Pyrene	8.9	< 10	< 6	< 0.29	< 3	< 0.29	< 3
Phenanthrene	30	4	3	0.25	< 0.3	< 0.033	< 0.3
Pyrene	30	10	7	0.47	2	< 0.033	2

STORM DRAIN SYSTEMS NO. 1/2 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

	DITCH SAMPLE LOCATIONS			COLD SPRING BROOK SAMPLE LOCATIONS			
				UPSTREAM	DOWNSTREAM		
	SSD-93-01B 08/17/93 0 FT	CSD-94-29X 09/21/94 0 FT	CSD-94-30X 09/21/94 0 FT	CSD-94-31X 09/21/94 0 FT	CSD-94-32X 09/21/94 0 FT	CSD-94-33X 09/21/94 0 FT	CSD-94-34X 09/21/94 0 FT
PAL PESTICIDES/PCBS (µg/g)							
DDT	NA	NA	NA	NA	< 0.00707 M	NA	< 0.00707 M
DDD	NA	NA	NA	NA	0.024 C	NA	0.0537 C
DDE	NA	NA	NA	NA	< 0.00765	NA	< 0.00765
Dieldrin	NA	NA	NA	NA	< 0.00629 M	NA	< 0.00629 M
Endosulfan Sulfate	NA	NA	NA	NA	< 0.00763	NA	< 0.00763
gamma-chlordane	NA	NA	NA	.33ND R	3ND R	.33ND R	3ND R
OTHER (µg/g)							
Total Organic Carbon	30000	32500	58400	67400	42400	24600	64700
Total Petroleum Hydrocarbons	240	281	239	< 28.2	71.9	55.1	110

NOTES:
R = Non-target compound analyzed for but not detected.
M = Duplicate high spike analysis, not within control limits.
C = Analysis was confirmed.
NA = Not analyzed
ND = Not detectable
µg/g = micrograms/gram

STORM DRAIN SYSTEMS NO. 2/3/4 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATIONS					
	SSD-93-03B 08/17/93 0 FT	CSD-94-22X 09/20/94 0 FT	CSD-94-21X 09/20/94 0 FT	CSD-94-24X 09/20/94 0 FT	CSD-94-23X 09/20/94 0 FT	CSD-94-25X 09/20/94 0 FT
PAL METALS (µg/g)						
Aluminum	9380	6000	7840	29500	5000	14000
Antimony	< 19.6	< 1.09	10.6	18.8	< 1.09	3.48
Arsenic	19.2	8.4	18	60	8.55	19
Barium	46.2	12.7	30.9	155	15.9	63.9
Beryllium	ND	ND	ND	ND	ND	ND
Cadmium	3.74	0.947	2.18	27.7	< 0.7	6.35
Calcium	2240	3850	1140	3440	686	2040
Chromium	38.4	23.5	39.5	142	19.7	57.2
Cobalt	8	3.86	5.83	15.7	3.91	10.6
Copper	43.9	13.4	36.1	145	12.2	49
Iron	21900	12100	14300	42400	11100	20900
Lead	230	18	137	410	34.8	166
Magnesium	4200	5020	3910	14900	2430	6360
Manganese	572	231	174	551	172	423
Mercury	0.0751	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel	22.3	18.3	22.7	82.1	15	38.3
Potassium	1140	552	1040	4610	583	1860
Selenium	ND	ND	ND	ND	ND	ND
Sodium	108	327	564	1650	412	840
Vanadium	28.2	19.6	24	91.4	14.2	39.5
Zinc	171	46.9	115	573	41	184
PAL SEMIVOLATILE ORGANICS (µg/g)						
2-methylnaphthalene	2.1	< 1	< 1	< 5	< 0.5	< 2
2-methylphenol / 2-cresol	0.35	< 0.6	< 0.6	< 3	0.3	< 1
4-methylphenol / 4-cresol	2.2	< 5	< 5	< 20	2	< 10
9h-carbazole	ND	ND	ND	ND	ND	ND
Acenaphthene	3.6	1	< 0.7	< 4	0.4	< 2
Acenaphthylene	30	< 0.7	< 0.7	< 3	0.3	< 2
Anthracene	30	2	1	< 3	0.6	< 2
Benzo [a] Anthracene	60	6	9	< 20	2	< 8
Benzo [a] Pyrene	60	< 5	10	< 20	< 2	< 10
Benzo [b] Fluoranthene	60	10	20	< 20	6	< 10
Benzo [g,h,i] Perylene	30	< 5	< 5	< 20	< 2	< 10
Benzo [k] Fluoranthene	70	2	6	< 7	1	< 3
Bis(2-ethylhexyl) Phthalate	ND	ND	ND	ND	ND	ND
Chrysene	90	10	10	< 10	6	< 6
Dibenz [a,h] Anthracene	1.7	< 4	< 4	< 20	< 2	< 10

STORM DRAIN SYSTEMS NO. 2/3/4 AND ASSOCIATED LOWER COLD SPRING BROOK ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATIONS					
	SSD-93-03B 08/17/93 0 FT	CSD-94-22X 09/20/94 0 FT	CSD-94-21X 09/20/94 0 FT	CSD-94-24X 09/20/94 0 FT	CSD-94-23X 09/20/94 0 FT	CSD-94-25X 09/20/94 0 FT
Dibenzofuran	2.6	1	< 0.7	< 4	< 0.4	< 2
Fluoranthene	100	20	20	50	8	20
Fluorene	8.1	2	< 0.7	< 3	< 0.3	< 2
Indeno [1,2,3-c,d] Pyrene	ND	ND	ND	ND	ND	ND
Naphthalene	3.6	< 0.7	< 0.7	< 4	< 0.4	< 2
Phenanthrene	100	20	10	20	5	7
Pyrene	200	20	20	40	7	20
PAL VOLATILE ORGANICS (µg/g)						
1,1,1-trichloroethane	ND	NA	NA	NA	NA	NA
Acetone	ND	NA	NA	NA	NA	NA
Toluene	ND	NA	NA	NA	NA	NA
Tetrachloroethylene / Tetrachloroethene	0.24	NA	NA	NA	NA	NA
Trichlorofluoromethane	ND	NA	NA	NA	NA	NA
OTHER (µg/g)						
Total Organic Carbon	66000	5320	14700	154000	4490	54600
Total Petroleum Hydrocarbons	1200	625	2500	5490	625	1220

STORM DRAIN SYSTEMS NO. 2/3/4 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	COLD SPRING BROOK SAMPLE LOCATIONS			
	UPSTREAM		DOWNSTREAM	
	G3D-92-03X 06/23/92 0 FT	CSD-94-27X 09/20/94 0 FT	57D-92-02X 08/19/92 0 FT	CSD-94-28X 09/22/94 0 FT
PAL METALS (µg/g)				
Aluminum	12500	6190	NA	3410
Antimony	ND	ND	NA	ND
Arsenic	95.2	9.37	NA	7.65
Barium	127	35.3	NA	23.3
Beryllium	< 0.5	< 0.5	NA	< 0.5
Cadmium	ND	ND	NA	ND
Calcium	5810	1810	NA	898
Chromium	< 4.05	14.9	NA	8.5
Cobalt	< 1.42	7.86	NA	6.52
Copper	60.4	7.83	NA	4.14
Iron	15900	6590	NA	4800
Lead	350	8.17	NA	10.2
Magnesium	4610	2050	NA	1340
Manganese	339	524	NA	242
Mercury	ND	ND	NA	ND
Nickel	41	13.2	NA	8.67
Potassium	1520	308	NA	173
Selenium	< 0.25	< 0.25	NA	< 0.25
Sodium	2120	707	NA	516
Vanadium	72.5	8.45	NA	< 3.39
Zinc	372	31.4	NA	32.1
PAL SEMIVOLATILE ORGANICS (µg/g)				
2-methylnaphthalene	ND	ND	ND	ND
2-methylphenol / 2-cresol	ND	ND	ND	ND
4-methylphenol / 4-cresol	ND	ND	ND	ND
9h-carbazole	4.68 S	.1ND R	.033ND R	.1ND
Acenaphthene	ND	ND	ND	ND
Acenaphthylene	4.37	< 0.033	0.075	< 0.033
Anthracene	4.42	< 0.033	0.1	< 0.033
Benzo [a] Anthracene	18.1	< 0.17	0.35	0.27
Benzo [a] Pyrene	22.9	< 0.25	0.51	< 0.25
Benzo [b] Fluoranthene	32.7	< 0.21	0.67	< 0.21
Benzo [g,h,i] Perylene	18.9	< 0.25	0.34	< 0.25
Benzo [k] Fluoranthene	33.2	< 0.066	0.47	< 0.066
Bis(2-ethylhexyl) Phthalate	< 3.1	1.5	< 0.62	< 0.62
Chrysene	47.1	< 0.12	0.8	0.67
Dibenz [a,h] Anthracene	ND	ND	ND	ND

STORM DRAIN SYSTEMS NO. 2/3/4 AND ASSOCIATED LOWER COLD SPRING BROOK ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION FORT DEVENS, MA.

ANALYTE	COLD SPRING BROOK SAMPLE LOCATIONS			
	UPSTREAM		DOWNSTREAM	
	G3D-92-03X 06/23/92 0 FT	CSD-94-27X 09/20/94 0 FT	57D-92-02X 08/19/92 0 FT	CSD-94-28X 09/22/94 0 FT
Dibenzofuran	ND	ND	ND	ND
Fluoranthene	59.4	< 0.068	1.4	1.1
Fluorene	< 0.165	< 0.033	0.086	< 0.033
Indeno [1,2,3-c,d] Pyrene	20.3	< 0.29	0.33	< 0.29
Naphthalene	ND	ND	ND	ND
Phenanthrene	19.8	< 0.033	0.78	0.39
Pyrene	53.1	< 0.033	1.3	1.1
PAL VOLATILE ORGANICS ($\mu g/g$)				
1,1,1-trichloroethane	< 0.0044	NA	NA	NA
Acetone	< 0.017	NA	NA	NA
Toluene	< 0.00078	NA	NA	NA
Tetrachloroethylene / Tetrachloroethene	ND	NA	NA	NA
Trichlorofluoromethane	< 0.0059	NA	NA	NA
PAL PESTICIDES/PCBS ($\mu g/l$)				
DDT	NA	< 0.00707 M	NA	NA
DDD	NA	< 0.00826	NA	NA
DDE	NA	< 0.00765	NA	NA
Dieldrin	NA	< 0.00629 M	NA	NA
Endosulfan Sulfate	NA	< 0.00763	NA	NA
gamma-chlordane	2ND R	33ND R	33ND R	33ND R
OTHER ($\mu g/g$)				
Total Organic Carbon	219000	32500	24400	19700
Total Petroleum Hydrocarbons	827	< 28	92.6	47.3

NOTES:
M = Duplicate high spike analysis, not within control limits.
R = Non-target compound analyzed for but not detected.
S = Non-target compound analyzed for and detected.
NA = Not analyzed
ND = Not detectable
$\mu g/g$ = micrograms per gram

BOWERS BROOK AND ASSOCIATED LOWER COLD SPRING BROOK ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION FORT DEVENS, MA.

ANALYTE	BOWERS BROOK SAMPLE LOCATION	COLD SPRING BROOK SAMPLE LOCATIONS		
		UPSTREAM	DOWNSTREAM	
	CSD-94-16X 09/22/94 0 FT	G3D-92-02X 06/24/92 0 FT	CSD-94-18X 09/22/94 0 FT	CSD-94-26X 09/20/94 0 FT
PAL INORGANICS (µg/g)				
Aluminum	7550	12800	8910	7860
Arsenic	57.9	96	63	7.79
Barium	65.4	188	97.3	39.1
Beryllium	< 0.5	< 0.5	< 0.5	< 0.5
Calcium	3060	17000	3150	1400
Chromium	< 4.05	< 4.05	< 4.05	19.8
Cobalt	23.4	19	36	6
Copper	20.8	54.9	21.8	2.34
Iron	11800	23200	24400	6820
Lead	89	220	67	6.9
Magnesium	2070	3210	2360	2140
Manganese	1140	3150	1360	275
Nickel	22.6	41.5	26.4	12.9
Potassium	< 100	1130	555	294
Selenium	< 0.25	2.89	< 0.25	< 0.25
Sodium	2570	1620	1730	692
Vanadium	< 3.39	41.4	23.9	10.9
Zinc	147	398	193	19.9
PAL SEMIVOLATILE ORGANICS				
9h-carbazole	.1ND R	.165ND R	.5ND R	.1ND R
Acenaphthylene	< 0.033	< 0.165	< 0.2	< 0.033
Anthracene	< 0.033	< 0.165	< 0.2	< 0.033
Benzo [a] Anthracene	< 0.17	< 0.8	< 0.8	< 0.17
Benzo [a] Pyrene	< 0.25	< 1.25	< 1	< 0.25
Benzo [b] Fluoranthene	< 0.21	< 1.05	< 1	< 0.21
Benzo [g,h,i] Perylene	< 0.25	< 1.25	< 1	< 0.25
Benzo [k] Fluoranthene	1.1	< 0.33	< 0.3	< 0.066
Bis (2-ethylhexyl) Phthalate	< 0.62	< 3.1	< 3	< 0.62
Chrysene	1.3	< 0.6	< 0.6	< 0.12
Fluoranthene	1.6	4.5	< 0.3	< 0.068
Fluorene	< 0.033	< 0.165	< 0.2	< 0.033
Indeno [1,2,3-c,d] Pyrene	< 0.29	< 1.45	< 1	< 0.29
Phenanthrene	1.1	2.22	< 0.2	< 0.033
Pyrene	2.6	4.59	1	< 0.033
PAL VOLATILE ORGANICS (µg/g)				
1,1,1-trichloroethane	NA	< 0.0044	NA	NA
Acetone	NA	0.49	NA	NA
Toluene	NA	< 0.00078	NA	NA
Trichlorofluoromethane	NA	< 0.0059	NA	NA
PAL PESTICIDES/PCBS (µg/g)				
DDT	NA	NA	< 0.00707 M	NA
DDD	NA	NA	0.0498 C	NA
DDE	NA	NA	< 0.00765	NA
Dieldrin	NA	NA	< 0.00629 M	NA
Endosulfan Sulfate	NA	NA	< 0.00763	NA
gamma-chlordane	.33ND R	2ND R	2ND R	.33ND R
OTHER				
Total Organic Carbon	104000	166000	113000	18500
Total Petroleum Hydrocarbons	192	312	203	< 28.2

NOTES:
M = Duplicate high spike analysis, not within control limits.
C = Analysis was confirmed.
R = Non-target compound analyzed for but not detected.
NA = Not analyzed
ND = Not Detected
µg/g = micrograms per gram

STUDY AREA 57 MARSH AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	MARSH SAMPLE LOCATIONS				
	CSD-94-20X 09/22/94 0 FT	CSD-94-20X 09/22/94 0 FT (dup)	CSD-94-14X 09/22/94 0 FT	CSD-94-35X 09/22/94 0 FT	CSD-94-17X 09/22/94 0 FT
PAL METALS ($\mu g/g$)					
Aluminum	20200	21600 D	8820	8540	5160
Arsenic	21	22.3 D	11.5	26.7	26
Barium	78.8	84.2 D	< 5.18	74.3	37.1
Beryllium	ND	ND	ND	ND	ND
Cadmium	2.96	3 D	< 0.7	< 0.7	< 0.7
Calcium	2840	4890 D	10800	13000	4140
Chromium	53.2	56.7 D	< 4.05	31.6	14.6
Cobalt	9.12	10.4 D	< 1.42	8.41	5.15
Copper	39.2	44.2 D	93	44.6	16.2
Iron	21600	22800 D	5790	12100	7560
Lead	222	248 D	240	120	95
Magnesium	5340	5690 D	1610	2470	1590
Manganese	161	174 D	41.7	265	473
Nickel	33.8	37.2 D	< 1.71	22	15.3
Potassium	1620	1600 D	< 100	563	427
Selenium	0.925	0.924 D	9.46	2.61	1.17
Sodium	819	984 D	5930	2210	1020
Vanadium	38.4	41.2 D	< 3.39	23.1	16.9
Zinc	160	176 D	176	209	124
PAL SEMIVOLATILE ORGANICS ($\mu g/g$)					
9h-carbazole	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND	ND
Benzo [a] Anthracene	ND	ND	ND	ND	ND
Benzo [a] Pyrene	ND	ND	ND	ND	ND
Benzo [b] Fluoranthene	ND	ND	ND	ND	ND
Benzo [g,h,i] Perylene	ND	ND	ND	ND	ND
Benzo [k] Fluoranthene	< 3	< 3 D	< 0.7	< 0.7	1
Bis (2-ethylhexyl) Phthalate	ND	ND	ND	ND	ND
Chrysene	< 6	< 6 D	< 1	< 1	1
Fluoranthene	1	< 3 D	< 0.7	< 0.7	3

STUDY AREA 57 MARSH AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	MARSH SAMPLE LOCATIONS				
	CSD-94-20X 09/22/94 0 FT	CSD-94-20X 09/22/94 0 FT (dup)	CSD-94-14X 09/22/94 0 FT	CSD-94-35X 09/22/94 0 FT	CSD-94-17X 09/22/94 0 FT
Fluorene	ND	ND	ND	ND	ND
Indeno [1,2,3-c,d] Pyrene	ND	ND	ND	ND	ND
Phenanthrene	0.8	< 2 D	< 0.3	< 0.3	1
Pyrene	2	< 2 D	< 0.3	< 0.3	3
PAL VOLATILE ORGANICS (µg/g)					
1,1,1,-trichloroethane	ND	ND	ND	ND	ND
Acetone	0.035	0.052 D	< 0.017	0.11	< 0.017
Toluene	0.0016	< 0.00078 D	< 0.00078	0.0047	< 0.00078
Trichlorofluoromethane	0.031	0.041 D	0.35	0.099	0.033
PAL PESTICIDES/PCBS (µg/g)					
DDT	0.083 CM	0.09 CDM	NA	NA	NA
DDD	0.04 C	0.041 CD	NA	NA	NA
DDE	0.0338 C	0.035 CD	NA	NA	NA
alpha chlordane	0.013 CS	0.0123 CSD	3ND R	3ND R	2ND R
Dieldrin	0.0298 CM	0.0311 CDM	NA	NA	NA
Endosulfan Sulfate	ND	ND	NA	NA	NA
gamma-chlordane	0.0276 CS	0.0298 CSD	3ND R	3ND R	2ND R
Aroclor 1260	0.243 C	0.309 C	30ND R	30ND R	20ND R
OTHER (µg/g)					
Total Organic Carbon	63600	56700 D	266000	148000	58400
Total Petroleum Hydrocarbons	2700	1760 D	1380	251	375

STUDY AREA 57 MARSH AND ASSOCIATED LOWER COLD SPRING BROOK ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION FORT DEVENS, MA.

ANALYTE	COLD SPRING BROOK SAMPLE LOCATIONS		
	UPSTREAM	DOWNSTREAM	
	CSD-94-13X 09/22/94 0 FT	SSD-93-92G 09/16/93 0 FT	CSD-94-19X 09/22/94 0 FT
PAL METALS (µg/g)			
Aluminum	10000	20100	6130
Arsenic	65	51.1	53
Barium	90.1	118	63.5
Beryllium	< 0.5	< 0.427	< 0.5
Cadmium	ND	ND	ND
Calcium	8380	5440	6980
Chromium	30.9	39.8	< 4.05
Cobalt	19	< 2.5	9.31
Copper	28.5	63.7	21.1
Iron	22300	30700	12700
Lead	240	340	79
Magnesium	3220	4340	1740
Manganese	1580	317	1490
Nickel	35.9	31.1	20.1
Potassium	608	1540	< 100
Selenium	3.01	< 0.449	2.34
Sodium	< 100	38.7	1820
Vanadium	31.8	45.6	15.8
Zinc	305	290 JR	147
PAL SEMIVOLATILE ORGANICS (µg/g)			
9h-carbazole	.5ND R	ND	.5ND R
Acenaphthylene	< 0.2	< 0.033	< 0.2
Anthracene	< 0.2	< 0.71	< 0.2
Benzo [a] Anthracene	< 0.8	1.2	< 0.8
Benzo [a] Pyrene	< 1	< 1.2	< 1
Benzo [b] Fluoranthene	< 1	< 0.31	< 1
Benzo [g,h,i] Perylene	< 1	< 0.18	< 1
Benzo [k] Fluoranthene	2	< 0.13	< 0.3
Bis (2-ethylhexyl) Phthalate	< 3	< 0.48	< 3
Chrysene	< 0.6	< 0.032	< 0.6
Fluoranthene	6	1	2

STUDY AREA 57 MARSH AND ASSOCIATED LOWER COLD SPRING BROOK ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION FORT DEVENS, MA.

ANALYTE	COLD SPRING BROOK SAMPLE LOCATIONS					
	UPSTREAM		DOWNSTREAM			
	CSD-94-13X 09/22/94 0 FT		SSD-93-92G 09/16/93 0 FT		CSD-94-19X 09/22/94 0 FT	
Fluorene	<	0.2	<	0.065	<	0.2
Indeno [1,2,3-c,d] Pyrene	<	1	<	2.4	<	1
Phenanthrene		2		1.1		1
Pyrene		6		2.1		2
PAL VOLATILE ORGANICS (µg/g)						
1,1,1,-trichloroethane	<	0.0044	<	0.2	<	0.0044
Acetone		0.22	<	3.3		0.66
Toluene		0.0043	<	0.1		0.0033
Trichlorofluoromethane		0.096	<	0.23		0.1
PAL PESTICIDES/PCBS (µg/g)						
DDT		0.0553 C M	<	0.1		NA
DDD		0.49 C	<	0.064		NA
DDE		0.14 C		0.0206		NA
alpha chlordane		ND		ND		NA
Dieldrin	<	0.00629 M		0.0192		NA
Endosulfan Sulfate	<	0.00763	<	1.2		NA
gamma-chlordane		ND		ND		NA
Aroclor 1260		0.0392 C S		ND		2ND R
OTHER (µg/g)						
Total Organic Carbon		124000		170000		161000
Total Petroleum Hydrocarbons		460		1800		242

NOTES:
D = duplicate
R = Non-target compound analyzed for but not detected.
S = Non-target compound analyzed for and detected.
C = Analysis was confirmed
M = Duplicate high spike analysis, not within control limits.
NA = Not analyzed
ND = Not detectable
µg/g = micrograms per gram

STORM DRAIN SYSTEM NO. 6 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS
LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATIONS				
	SSD-93-06B 08/18/93 0 FT	SSD-93-06B 08/18/93 0 FT (dup)	57S-92-01X 08/19/92 0 FT	57S-92-02X 08/19/92 0 FT	57S-92-03X 08/19/92 0 FT
PAL METALS ($\mu g/g$)					
Aluminum	5750	9680 D	NA	NA	NA
Arsenic	10.3	20.9 D	NA	NA	NA
Barium	24	69 D	NA	NA	NA
Beryllium	ND	ND	NA	NA	NA
Cadmium	< 1.2	3.82 D	NA	NA	NA
Calcium	1190	1760 D	NA	NA	NA
Chromium	27.1	64.6 D	NA	NA	NA
Cobalt	4.23	7.39 D	NA	NA	NA
Copper	40.7	105 D	NA	NA	NA
Iron	14900	21800 D	NA	NA	NA
Lead	140	420 D	NA	NA	NA
Magnesium	2500	3770 D	NA	NA	NA
Manganese	184	320 D	NA	NA	NA
Mercury	< 0.05	0.115 D	NA	NA	NA
Nickel	14.1	22.8 D	NA	NA	NA
Potassium	885	1670 D	NA	NA	NA
Selenium	ND	ND	NA	NA	NA
Sodium	76.2	138 D	NA	NA	NA
Tin	< 7.43	13.5 D	NA	NA	NA
Vanadium	16.8	36.8 D	NA	NA	NA
Zinc	83.1	189 D	NA	NA	NA
PAL SEMIVOLATILE ORGANICS ($\mu g/g$)					
9-h carbazole	ND	ND	ND	ND	ND
2-methylnaphthalene	0.19	0.15 D	< 1	< 2	< 2
Acenaphthene	0.22	0.18 D	< 0.7	< 1	< 1
Acenaphthylene	3.2	2.7 D	< 0.7	< 1	< 1
Anthracene	3	2.5 D	< 0.7	< 1	< 1
Benzo [a] Anthracene	3.5	2.7 D	< 3	< 7	< 7
Benzo [a] Pyrene	4.1	3.1 D	< 5	< 10	< 10
Benzo [b] Fluoranthene	4.9	3.5 D	< 4	< 8	< 8
Benzo [g,h,i] Perylene	4.9	3.1 D	< 5	< 10	< 10
Benzo [k] Fluoranthene	3.6	3 D	< 1	4	4
Bis (2-ethylhexyl) Phthalate	1.4	< 0.48 D	< 10	< 20	< 20
Chrysene	4.3	3.3 D	< 2	5	5
Di-n-butyl Phthalate	9.3	6.2GT D	< 1	< 2	< 2

STORM DRAIN SYSTEM NO. 6 AND ASSOCIATED LOWER COLD SPRING BROOK ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATIONS				
	SSD-93-06B 08/18/93 0 FT	SSD-93-06B 08/18/93 0 FT (dup)	57S-92-01X 08/19/92 0 FT	57S-92-02X 08/19/92 0 FT	57S-92-03X 08/19/92 0 FT
Dibenz [a,h] Anthracene	0.83	< 0.31 D	< 4	< 8	< 8
Fluoranthene	5.2	4 D	< 1	9	10
Fluorene	0.61	< 0.065 D	< 0.7	< 1	< 1
Indeno [1,2,3-c,d] Pyrene	ND	ND	ND	ND	ND
Phenanthrene	4.6	3.2 D	< 0.7	4	4
Pyrene	5.9	4.6 D	< 0.7	10	10
PAL VOLATILE ORGANICS (µg/g)					
1,1,1-trichloroethane	ND	ND	NA	NA	NA
Acetone	ND	ND	NA	NA	NA
Toluene	ND	ND	NA	NA	NA
Trichlorofluoromethane	ND	ND	NA	NA	NA
OTHER (µg/g)					
Total Organic Carbon	75000	NA	24500	24700	18400
Total Petroleum Hydrocarbons	3500	2600 D	1860	1410	2210

STORM DRAIN SYSTEM NO. 6 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	COLD SPRING BROOK SAMPLE LOCATIONS			
	UPSTREAM	DOWNSTREAM		
	CSD-94-10X 09/20/94 0 FT	CSD-94-11X 09/21/94 0 FT	CSD-94-12X 09/21/94 0 FT	G3D-92-01X 06/23/92 0 FT
PAL METALS (µg/g)				
Aluminum	5030	12300	11800	17400
Arsenic	26.8	47.4	67	120
Barium	41.9	83.7	103	121
Beryllium	< 0.5	< 0.5	< 0.5	4.37
Cadmium	ND	ND	ND	ND
Calcium	4500	8540	9740	13500
Chromium	16.7	44.5	39.7	50.7
Cobalt	5.78	16	17.2	29.8
Copper	10	35.7	37.9	42.2
Iron	8150	19200	23200	33100
Lead	55.5	273	258	340
Magnesium	1460	3650	3250	4960
Manganese	1340	934	1840	1020
Mercury	ND	ND	ND	ND
Nickel	11.6	35.2	33.6	55.1
Potassium	< 100	840	666	1580
Selenium	1.09	2.98	2.57	< 0.25
Sodium	909	1830	2000	727
Tin	ND	ND	ND	ND
Vanadium	11	38.4	34.3	50.2
Zinc	63.2	336	341	479
PAL SEMIVOLATILE ORGANICS (µg/g)				
9-h carbazole	ND	ND	ND	ND
2-methylnaphthalene	.1ND R	.5ND R	.5ND R	.165ND R
Acenaphthene	ND	ND	ND	ND
Acenaphthylene	< 0.033	< 0.2	< 0.2	< 0.165
Anthracene	< 0.033	< 0.2	< 0.2	< 0.165
Benzo [a] Anthracene	0.42	< 0.8	< 0.8	< 0.8
Benzo [a] Pyrene	< 0.25	< 1	< 1	< 1.25
Benzo [b] Fluoranthene	< 0.21	< 1	< 1	< 1.05
Benzo [g,h,i] Perylene	< 0.25	< 1	< 1	< 1.25
Benzo [k] Fluoranthene	0.47	5	2	< 0.33
Bis (2-ethylhexyl) Phthalate	< 0.62	< 3	< 3	< 3.1
Chrysene	0.84	6	< 0.6	< 0.6
Di-n-butyl Phthalate	ND	ND	ND	ND

STORM DRAIN SYSTEM NO. 6 AND ASSOCIATED LOWER COLD SPRING BROOK ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION FORT DEVENS, MA.

ANALYTE	COLD SPRING BROOK SAMPLE LOCATIONS			
	UPSTREAM	DOWNSTREAM		
	CSD-94-10X 09/20/94 0 FT	CSD-94-11X 09/21/94 0 FT	CSD-94-12X 09/21/94 0 FT	G3D-92-01X 06/23/92 0 FT
Dibenz [a,h] Anthracene	ND	ND	ND	ND
Fluoranthene	0.89	9	3	3.69
Fluorene	< 0.033	< 0.2	< 0.2	< 0.165
Indeno [1,2,3-c,d] Pyrene	< 0.29	< 1	< 1	< 1.45
Phenanthrene	0.55	5	2	2.63
Pyrene	1.6	9	6	7.54
PAL VOLATILE ORGANICS (µg/g)				
1,1,1-trichloroethane	NA	NA	NA	< 0.0044
Acetone	NA	NA	NA	0.657
Toluene	NA	NA	NA	< 0.00078
Trichlorofluoromethane	NA	NA	NA	< 0.0059
PAL PESTICIDES/PCBS (µg/g)				
DDT	NA	0.0923 CM	NA	NA
DDD	NA	0.41 C	NA	NA
DDE	NA	0.2 C	NA	NA
Dieldrin	NA	< 0.00629 CM	NA	NA
Endosulfan Sulfate	NA	< 0.00763	NA	NA
gamma-chlordane	.33ND R	0.0663 C S	2ND R	2ND R
OTHER (µg/g)				
Total Organic Carbon	85700	149000	223000	4250
Total Petroleum Hydrocarbons	272	534	574	472

NOTES:
D = duplicate
M = Duplicate high spike analysis, not within control limits.
C = Analysis was confirmed.
R = Non-target compound analyzed for but not detected.
S = Non-target compound analyzed for and detected.
NA = Not analyzed
ND = Not detectable
µg/g = micrograms per gram

STORM DRAIN SYSTEM NO. 7 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATIONS						
	CSD-94-04X 09/19/94 0 FT	SSD-93-07A 08/18/93 0 FT	CSD-94-05 09/19/94 0 FT	CSD-94-05 09/19/94 0 FT (dup)	SSD-93-07B 08/18/93 0 FT	CSD-94-06 09/19/94 0 FT	CSD-94-07 09/19/94 0 FT
PAL METALS (μg/g)							
Aluminum	4280	6760	13900	2670 D	20900	6210	9760
Arsenic	12.8	9.91	37.9	38.4 D	41.6	9.75	16.2
Barium	36.2	9.65	207	< 5.18 D	545	28.5	82.8
Beryllium	< 0.5	< 0.427	3.37	< 0.5 D	8.35	< 0.5	< 0.5
Cadmium	< 0.7	< 1.2	6.43	< 0.7 D	10.6	< 0.7	< 0.7
Calcium	1040	6450	6470	1020 D	6910	1430	2430
Chromium	< 4.05	18.6	< 4.05	< 4.05 D	9.64	30.2	40.5
Cobalt	21.7	4.39	116	20.6 D	298	4.32	15
Copper	7.31	20.6	28	< 0.965 D	36.2	13.5	22
Iron	9230	15900	28300	4790 D	67800	10300	19600
Lead	17	26	136	83 D	91	109	212
Magnesium	817	2960	1390	< 100 D	923	3280	4600
Manganese	1610	189	5560	843 D	25000	264	1340
Nickel	19.4	13.7	145	23.2 D	140	16.5	34.4
Potassium	< 100	544	< 100	< 100 D	< 131	916	1290
Selenium	< 0.25	< 0.449	2.18	< 0.25 D	< 0.449	< 0.25	< 0.25
Sodium	775	67.2	1980	< 100 D	455	642	932
Vanadium	< 3.39	10.8	25.7	< 3.39 D	24.6	16.1	27.4
Zinc	69	46.9	604	105 D	415	69.9	158
PAL SEMIVOLATILE ORGANICS (μg/g)							
9-h carbazole	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	< 0.033	0.36	< 0.033	< 0.033 D	< 0.033	< 0.3	< 0.2
Anthracene	ND	ND	ND	ND	ND	ND	ND
Benzo [a] Anthracene	< 0.17	0.64	< 0.17	< 0.17 D	< 0.041	< 2	< 0.8
Benzo [a] Pyrene	ND	ND	ND	ND	ND	ND	ND
Benzo [k] Fluoranthene	< 0.066	0.76	< 0.066	0.48 D	< 0.13	< 0.7	3
Benzo [g,h,i] Perylene	ND	ND	ND	ND	ND	ND	ND
Benzo [k] Fluoranthene	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl) Phthalate	ND	ND	ND	ND	ND	ND	ND
Chrysene	< 0.12	0.84	< 0.12	0.94 D	< 0.032	< 1	3
Di-n-butyl Phthalate	< 0.061	5.5	< 0.061	< 0.061 D	22	< 0.6	< 0.3
Fluoranthene	0.27	1	1.3	1.7 D	1	2	6
Fluorene	ND	ND	ND	ND	ND	ND	ND
Indeno [1,2,3-c,d] Pyrene	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	0.16	1	0.74	0.92 D	< 0.032	2	3
Pyrene	0.28	1.5	1.4	1.4 D	< 0.083	2	5

06-Dec-95

STORM DRAIN SYSTEM NO. 7 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATIONS						
	CSD-94-04X 09/19/94 0 FT	SSD-93-07A 08/18/93 0 FT	CSD-94-05 09/19/94 0 FT	CSD-94-05 09/19/94 0 FT (dup)	SSD-93-07B 08/18/93 0 FT	CSD-94-06 09/19/94 0 FT	CSD-94-07 09/19/94 0 FT
PAL VOLATILE ORGANICS ($\mu g/g$)							
1,1,1-trichloroethane	NA	ND	NA	NA	NA	NA	NA
Acetone	NA	ND	NA	NA	NA	NA	NA
Toluene	NA	ND	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	ND	NA	NA	NA	NA	NA
OTHER							
Total Organic Carbon	41700	9600	85600	199000 D	1500000	27800	63200
Total Petroleum Hydrocarbons	219	250	470	481 D	300	2320	1590

STORM DRAIN SYSTEM NO. 7 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	COLD SPRING BROOK SAMPLE LOCATIONS				
	UPSTREAM		DOWNSTREAM		
	57D-92-01X 01/11/93 0 FT	57D-92-01X 08/19/92 0 FT	CSD-94-08X 09/19/94 0 FT	CSD-94-09X 09/20/94 0 FT	SSD-93-92E 09/08/93 0 FT
PAL METALS (μg/g)					
Aluminum	11700	NA	6770	9330	18000
Arsenic	55.3 J	NA	20.7	39	54.7
Barium	93.9	NA	61.2	92.3	125
Beryllium	< 0.5	NA	< 0.5	< 0.5	< 0.427
Cadmium	ND	NA	ND	ND	ND
Calcium	9100	NA	2410	5760	12500
Chromium	33.3	NA	26.1	31	44.3
Cobalt	21.3	NA	10.7	16.2	22.4
Copper	27.8	NA	16.4	28.1	30.1
Iron	25600	NA	14600	20400	35000
Lead	99	NA	141	180	190
Magnesium	3160	NA	2990	2790	4520
Manganese	1400	NA	1030	2040	2440
Nickel	32.2	NA	24.6	30.4	31.3
Potassium	799	NA	816	727	1160
Selenium	< 0.25	NA	< 0.25	1.78	< 0.449
Sodium	1110	NA	945	1230	349
Vanadium	32.4	NA	17.8	26.9	37
Zinc	239	NA	143	234	359
PAL SEMIVOLATILE ORGANICS (μg/g)					
9-h carbazole	.5ND R	2ND R	.5ND R	.5ND	
Acenaphthylene	< 0.2	< 0.2	< 0.2	< 0.2	< 0.033
Anthracene	< 0.2	< 0.2	< 0.2	< 0.2	< 0.71
Benzo [a] Anthracene	< 0.8	< 0.8	< 0.8	< 0.8	1.6
Benzo [a] Pyrene	< 1	< 1	< 1	< 1	< 1.2
Benzo [k] Fluoranthene	< 1	< 1	< 1	< 1	< 0.31
Benzo [g,h,i] Perylene	< 1	< 1	< 1	< 1	< 0.18
Benzo [k] Fluoranthene	< 0.3	< 0.3	1	< 0.3	< 0.13
Bis(2-ethylhexyl) Phthalate	< 3	< 3	< 3	< 3	< 0.48
Chrysene	< 0.6	< 0.6	2	4	< 0.032
Di-n-butyl Phthalate	ND	ND	ND	ND	ND
Fluoranthene	< 0.3	2	4	4	1.8
Fluorene	< 0.2	< 0.2	< 0.2	< 0.2	< 0.065
Indeno [1,2,3-c,d] Pyrene	< 1	< 1	< 1	< 1	< 2.4
Phenanthrene	< 0.2	1	3	2	1.8
Pyrene	< 0.2	2	3	6	2.7

STORM DRAIN SYSTEM NO. 7 AND ASSOCIATED LOWER COLD SPRING BROOK ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION FORT DEVENS, MA.

ANALYTE	COLD SPRING BROOK SAMPLE LOCATIONS				
	UPSTREAM		DOWNSTREAM		
	57D-92-01X 01/11/93 0 FT	57D-92-01X 08/19/92 0 FT	CSD-94-08X 09/19/94 0 FT	CSD-94-09X 09/20/94 0 FT	SSD-93-92E 09/08/93 0 FT
PAL VOLATILE ORGANICS (µg/g)					
1,1,1-trichloroethane	< 0.0044	NA	NA	NA	< 0.2
Acetone	0.44	NA	NA	NA	< 3.3
Toluene	< 0.00078	NA	NA	NA	< 0.1
Trichlorofluoromethane	< 0.0059	NA	NA	NA	< 0.23
PAL PESTICIDES/PCBS (µg/g)					
DDT	NA	NA	0.0202 C	NA	< 0.1
DDD	NA	NA	0.0518 C	NA	0.062
DDE	NA	NA	< 0.00765	NA	< 0.068
Dieldrin	NA	NA	< 0.00629	NA	< 0.079
Endosulfan Sulfate	NA	NA	< 0.00763	NA	0.0112
gamma-chlordane	2ND R	2ND R	2ND R	2ND	
OTHER					
Total Organic Carbon	NA	34800	75700	132000	170000
Total Petroleum Hydrocarbons	466	497	734	635	160

NOTES:
D = duplicate
C = Analysis was confirmed
R = Non-target compound analyzed for but not detected
NA = Not analyzed
ND = Not detectable
µg/g = micrograms per gram

STORM DRAIN SYSTEM NO. 8 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATION SSD−93−08A 08/18/93 0 FT	COLD SPRING BROOK SAMPLE LOCATIONS UPSTREAM CSD−94−03X 09/20/94 0 FT	COLD SPRING BROOK SAMPLE LOCATIONS DOWNSTREAM SSD−93−92D 09/07/93 0 FT
PAL METALS (µg/g)			
Aluminum	14300	3590	15400
Arsenic	13.2	14	25.8
Barium	49.2	15.7	72.8
Beryllium	0.945	ND	< 0.427
Calcium	1510	1010	3140
Chromium	38	8.53	39.4
Cobalt	13.8	2.98	11.7
Copper	26	6.39	4.76
Iron	19200	7020	37200
Lead	110	30.8	34
Magnesium	3040	1330	11000
Manganese	595	516	1500
Mercury	ND	< 0.05 J	ND
Nickel	17.9	8.98	37.4
Potassium	1430	194	3830
Selenium	ND	< 0.25	< 0.449
Sodium	121	502	91
Vanadium	26.4	6.45	26.9
Zinc	190	48.7	85.2
PAL SEMIVOLATILE ORGANICS (µg/g)			
9h−carbazole	ND	1ND R	ND
Acenaphthylene	ND	< 0.033	< 0.033
Anthracene	ND	< 0.033	< 0.71
Benzo [a] Anthracene	ND	< 0.17	< 0.041
Benzo [a] Pyrene	ND	< 0.25	< 1.2
Benzo [b] Fluoranthene	ND	< 0.21	< 0.31
Benzo [g,h,i] Perylene	ND	< 0.25	< 0.18
Benzo [k] Fluoranthene	ND	0.15	< 0.13
Bis (2−ethylhexyl) Phthalate	ND	ND	< 0.48
Chrysene	0.4	0.25	< 0.032
Di−n−butyl Phthalate	2.1	ND	ND
Fluoranthene	0.53	0.29	< 0.032
Fluorene	ND	< 0.033	< 0.065
Indeno [1,2,3−c,d] Pyrene	ND	< 0.29	< 2.4
Naphthalene	ND	< 0.037	ND
Phenanthrene	0.48	0.15	< 0.032
Pyrene	0.45	0.4	< 0.083
PAL VOLATILE ORGANICS (µg/g)			
1,1,1 − trichloroethane	ND	NA	0.28
Acetone	ND	NA	< 3.3
Toluene	ND	NA	< 0.1
Trichlorofluoromethane	ND	NA	< 0.23
PAL PESTICIDES/PCBS (µg/g)			
DDT	NA	0.012 CM	< 0.1
DDD	NA	0.0324 C	< 0.064
DDE	NA	0.0234 C	< 0.068
Dieldrin	NA	ND	< 0.079
Endosulfan Sulfate	NA	ND	< 1.2
gamma−chlordane	NA	.33ND R	
OTHER (µg/g)			
Total Organic Carbon	66000	22000	50000
Total Petroleum Hydrocarbons	780	103	23

NOTES:
C = Analysis was confirmed
M = Duplicate high spike analysis, not within control limits.
[illegible] Non−target compound analyzed for but not detected.
NA = Not analyzed
ND = Not detectable
µg/g = micrograms per gram

STORM DRAIN SYSTEM NO. 9 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATIONS			COLD SPRING BROOK SAMPLE LOCATIONS					
				UPSTREAM		DOWNSTREAM			
	SSD-95-09L	SSD-95-09K	SSD-93-09A 8/19/93 0 FT	SSD-93-92C	SSD-95-09J	SSD-95-09I	CSD-94-01X 09/20/94 0 FT	CSD-94-02X 09/21/94 0 FT	SSD-95-09H
PAL METALS (µg/g)									
Aluminum	11600 B	3320 B	5850	3080	4780 B	4400 B	1720	13100	2440 B
Arsenic	24.8	4.25	17.5	13.1	13.3	12.1	11.9	62	9.4
Barium	64.4 B	16.3 B	19.5	7.85	18.9 B	10.8 B	< 5.18	117	16.8 B
Calcium	4750 B	779 B	1080	482	1870 B	661 B	408	6780	788 B
Chromium	46.6	9.38	17.4	6.24	10.8	14.8	< 4.05	48	5.51
Cobalt	12.7	< 2.5	3.14	ND	< 2.5	< 2.5	< 1.42	9.6	23.2
Copper	62.9	6.24	11.1	ND	8.38	8.8	3.04	48.8	2.84
Iron	26300 B	6900 B	14200	6440	8030 B	9840 B	3450	28700	< 5080 B
Lead	82 B	13.2 B	52	6.31	32.6 B	54 B	5.48	241	10.6 B
Magnesium	4730 B	1410 B	3030	1370	1470 B	2730 B	637	4130	932 B
Manganese	864 B	62.6 B	108	214	195 B	64.1 B	61.5	861	517 B
Mercury	.163	< .05	ND	ND	< .05	< .05	< 0.05 J	0.247 J	.05
Nickel	29.3	5.02	13.6	3.94	7.09	9.52	4.12	33.5	< 26.3
Potassium	2560 B	849 B	672	ND	480 B	527 B	195	1380	< 197 B
Selenium	NA	NA	ND	ND	NA	NA	< 0.25	1.78	NA
Sodium	241	61.6	98	ND	112	< 38.7	409	1900	38.7
Vanadium	49.3 B	7.85 B	12.6	4.09	7.75 B	9.76 B	< 3.39	34.3	3.31 B
Zinc	272 BI	25.9 BI	43.6	18.1	40.8 BI	57.6 BI	15.2	332	16.5 BI
PAL SEMIVOLATILE ORGANICS (µg/g)									
2-methylnaphthalene	< .06	.3	NA	NA	.3	.2	NA	NA	.032
Acenaphthene	< .08	1	NA	NA	< .08	< .08	NA	NA	< .041
9h-carbazole	NA	NA	ND	ND	NA	NA	0.28 S	1ND R	NA
Acenaphthylene	< .07	.7	ND	0.15	< .07	.9	0.12	< 0.3	< .033
Anthracene	< 1	5	ND	ND	< 1	< 1	0.19	< 0.3	< .71
Bis(2-ethylhexyl) Phthalate	20	< 1	NA	NA	< 1	< 1	NA	NA	< .48
Benzo [a] Anthracene	.7	7	2	0.64	.7	7	0.7	< 2	< .041
Benzo [a] Pyrene	< 2	5	ND	ND	< 2	< 2	0.74	< 2	< 1.2
Benzo [b] Fluoranthene	< .6	9	ND	ND	< .6	10	0.68	< 2	< .31
Benzo [g,h,i] Perylene	< .4	2	ND	ND	< .4	< .4	0.38	< 2	< .18
Benzo [k] Fluoranthene	< .3	3	ND	0.51	< .3	4	0.61	< 0.7	< .13
Chrysene	1	6	3	0.68	.9	8	1.3	< 1	.032
Dibenzofuran	< .8	1	NA	NA	< .8	< .8	NA	NA	< .38
Di-n-butyl Phthalate	< 3	< 3	NA	NA	< 3	< 3	NA	NA	< 1.3
Fluoranthene	.9	10	ND	0.95	.8	9	2.1	5	< .032
Fluorene	< .1	4	ND	0.17	< .1	2	0.16	< 0.3	< .065

STORM DRAIN SYSTEM NO. 9 AND ASSOCIATED LOWER COLD SPRING BROOK
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATIONS			COLD SPRING BROOK SAMPLE LOCATIONS					
				UPSTREAM		DOWNSTREAM			
	SSD-95-09L	SSD-95-09K	SSD-93-09A 8/19/93 0 FT	SSD-93-92C	SSD-95-09J	SSD-95-09I	CSD-94-01X 09/20/94 0 FT	CSD-94-02X 09/21/94 0 FT	SSD-95-09H
Hexadecanoic Acid / Palmitic Acid	9 NB	2 NB	NA	NA	3 NB	2 NB	NA	NA	< 4 NB
Indeno [1,2,3-c,d] Pyrene	NA	NA	ND	ND	NA	NA	0.4	< 3	NA
Naphthalene	NA	NA	ND	ND	NA	NA	0.073	< 0.4	NA
Octadecanoic Acid	2 NB		NA	NA			NA	NA	< .81 NB
Phenanthrene	1	20	ND	1.7	1	10	1.6	3	< .032
Pyrene	1	10	ND	1.4	1	10	2.4	6	< .083
PAL PESTICIDES/PCBS (µg/g)									
Endosulfan Ii	.00296 C	< .0007	NA	NA	.00294 C2	.00305 C2	NA	NA	.0007
Dieldrin	.00504 C	.00235 C	NA	NA	.0118 C	.0135 C	NA	NA	< .0016
DDT	.0113 U2	.0056 U2	NA	NA	.0319 U2	.0216 U2	NA	0.15 CM	< .0035
DDD	.00541 C	.0121 C	NA	NA	.0927 C	.106GT 2X	NA	0.56 C	< .00505 C
DDE	.0113 U	.00428 C	NA	NA	.0774 U	.0203 C	NA	0.16 C	< .0027
gamma-chlordane	NA	NA	NA	NA	NA	NA	.33ND R	0.0716 CS	NA
OTHER (µg/g)									
Total Organic Carbon	125000	1490	51000	9600	36600	24200	2080	120000	7400
Total Petroleum Hydrocarbons	965	537	270	NA	77.8	315	61	2120	534

NOTES:
µg/g = micrograms per gram
s.u. = standard units
< = less than
2 = ending calibration not within acceptable limits
B = analyte found in method blank or QC blank
as well as the sample
I = low spike recovery is high
J = Value is estimated
M = Duplicate high spike analysis, not within control limits.
N = tentatively identified compound
R = Non-target compound analyzed for but not detected
S = Non-target compound analyzed for and detected
C = Analysis was confirmed
NA = Not analyzed
ND = Not detectable
X = analyte concentration is above the upper reporting level

STORM DRAIN SYSTEM NO. 5
ANALYTICAL SEDIMENT SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA.

ANALYTE	DITCH SAMPLE LOCATIONS SSD-93-05A 08/17/93 0 FT	GRD-94-06X 09/19/94 0 FT	GRD-94-07X 09/19/94 0 FT
PAL METALS ($\mu g/g$)			
Aluminum	30400	10700	42200
Arsenic	43	20	5.35
Barium	99	57	< 5.18
Beryllium	1.62	< 0.5	< 0.5
Cadmium	4.59	0.931	< 0.7
Calcium	6960	591	1830
Chromium	163	36.9	< 4.05
Cobalt	28.8	13.1	< 1.42
Copper	65.6	47.3	63
Iron	48700	16300	2200
Lead	160	356	160
Magnesium	17500	4080	< 100
Manganese	1300	2410	43.2
Mercury	< 0.05	0.0961	< 0.05
Nickel	82	25.3	< 1.71
Potassium	5950	755	< 100
Selenium	< 0.449	0.67	8.64
Sodium	270	448	5310
Vanadium	88.6	48.8	< 3.39
Zinc	301	63.7	< 8.03
PAL SEMIVOLATILE ORGANICS ($\mu g/g$)			
Acenaphthene	0.21	< 2	< 0.036
Acenaphthylene	3.8	< 3	< 0.033
Anthracene	4.5	< 2	< 0.033
Benzo [a] Anthracene	5.9	< 8	< 0.17
Benzo [a] Pyrene	5.8	< 10	< 0.25
Benzo [b] Fluoranthene	6.9	20	< 0.21
Benzo [g,h,i] Perylene	5	< 10	< 0.25
Benzo [k] Fluoranthene	6.2	10	< 0.066
Chrysene	7.4	20	< 0.12
Fluoranthene	7.3	30	< 0.068
Fluorene	0.91	< 2	< 0.033
Phenanthrene	8.4	10	< 0.033
Pyrene	12	30	0.66
OTHER ($\mu g/g$)			
Total Organic Carbon	55000	92600	428000
Total Petroleum Hydrocarbons	3200	1570	3200

NOTES:
$\mu g/g$ = micrograms per gram

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-01X 09/20/94	CSW-94-01X 09/20/94 (filtered)	CSW-94-02X 09/21/94	CSW-94-02X 09/21/94 (filtered)	CSW-94-03X 09/20/94	CSW-94-03X 09/20/94 (filtered)	CSW-94-08X 09/19/94	CSW-94-08X 09/19/94 (filtered)
PAL METALS (µg/L)								
Aluminum	< 141	< 141 F	297	< 141 F	< 141	< 141 F	< 141	< 141 F
Antimony	< 3.03	< 3.03 F	< 3.03	< 3.03 F	< 3.03	< 3.03 F	< 3.03	3.48 F
Arsenic	3.52	3.09 F	5.22	3.73 F	4.9	3.41 F	5.44	3.94 F
Barium	8.06	8.24 F	12.8	7.38 F	5.37	< 5 F	7.86	6.9 F
Beryllium	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F
Cadmium	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F
Calcium	23800	23900 F	24200	24300 F	23200	23100 F	22800	22200 F
Chromium	< 6.02	< 6.02 F	< 6.02	< 6.02 F	< 6.02	< 6.02 F	< 6.02	< 6.02 F
Cobalt	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F
Copper	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F
Iron	205	85.4 F	691	144 F	474	82.8 F	454	207 F
Lead	< 1.26	< 1.26 F	2.39	< 1.26 F	< 1.26	< 1.26 F	1.41	< 1.26 F
Magnesium	3380	3430 F	3410	3400 F	3270	3280 F	3260	3190 F
Manganese	49.5	48.1 F	59.2	44.7 F	45.1	10.1 F	64.4	56.4 F
Mercury	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F
Nickel	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F
Potassium	2160	1690 F	1350	1520 F	1080	1490 F	1830	1490 F
Selenium	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F
Sodium	21500	21800 F	21100	21400 F	20900	20800 F	20900	20400 F
Vanadium	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F
Zinc	< 21.1	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F
PAL PESTICIDES/PCBS (µg/L)								
4,4'-ddd			< .0233		< .0233		< .0233	
4,4'-ddt			< .034		< .034		< .034	
Bhc - Alpha			< .0385		< .0385		< .0385	
Bhc - Beta			< .024		< .024		< .024	
Bhc - Delta			< .0293		< .0293		< .0293	
Bhc - Gamma (lindane)			< .0507		< .0507		< .0507	
Endosulfan I			< .023		< .023		< .023	
Endrin Aldehyde			< .0285		< .0285		< .0285	
Heptachlor			< .0423		< .0423		< .0423	
Isodrin			< .0562		< .0562		< .0562	
PAL SEMIVOLATILE ORGANICS (µg/L)								
Bis(2-ethylhexyl) Phthalate	< 4.8		< 4.8		< 4.8		4.5	

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-01X 09/20/94	CSW-94-01X 09/20/94 (filtered)	CSW-94-02X 09/21/94	CSW-94-02X 09/21/94 (filtered)	CSW-94-03X 09/20/94	CSW-94-03X 09/20/94 (filtered)	CSW-94-08X 09/19/94	CSW-94-08X 09/19/94 (filtered)
PAL WET CHEMISTRY								
Alkalinity	47000		49000		48000		46000	
Chloride	66000		33000		33000		33000	
Sulfate								
Total Hardness	70400		71600		69600		67600	
Total Suspended Solids	< 4000		4000		< 4000		< 4000	
OTHER								
Total Organic Carbon (µg/L)								

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-09X 09/20/94	CSW-94-09X 09/20/94 (filtered)	CSW-94-10X 09/20/94	CSW-94-10X 09/20/94 (filtered)	CSW-94-11X 09/21/94	CSW-94-11X 09/21/94 (filtered)	CSW-94-12X 09/21/94	CSW-94-12X 09/21/94 (filtered)
PAL METALS (µg/L)								
Aluminum	< 141	< 141 F	< 141	< 141 F	< 141	< 141 F	402	< 141 F
Antimony	< 3.03	3.3 F	< 3.03	4.11 F	< 3.03	< 3.03 F	< 3.03	4.02 F
Arsenic	5.97	4.05 F	4.69	< 2.54 F	4.58	3.3 F	8.74	3.52 F
Barium	8.06	7.09 F	7.86	6.9 F	7.77	6.81 F	10.4	8.53 F
Beryllium	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F
Cadmium	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F
Calcium	22700	22200 F	23300	22000 F	22800	21300 F	22800	21900 F
Chromium	< 6.02	< 6.02 F	< 6.02	< 6.02 F	< 6.02	< 6.02 F	< 6.02	< 6.02 F
Cobalt	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F
Copper	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F
Iron	439	139 F	405	119 F	421	105 F	1200	112 F
Lead	< 1.26	< 1.26 F	< 1.26	< 1.26 F	< 1.26	< 1.26 F	5.1	< 1.26 F
Magnesium	3250	3170 F	3340	3160 F	3250	3080 F	3280	3140 F
Manganese	84.3	72.2 F	81.2	69.8 F	94.5	93.7 F	272	355 F
Mercury	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F
Nickel	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F
Potassium	1370	1590 F	1770	1820 F	1260	1460 F	1700	1410 F
Selenium	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F
Sodium	20500	20000 F	20600	19600 F	20000	19000 F	19800	19800 F
Vanadium	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F
Zinc	< 21.1	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F
PAL PESTICIDES/PCBS (µg/L)								
4,4'-ddd					< .0233			
4,4'-ddt					< .034			
Bhc - Alpha					< .0385			
Bhc - Beta					< .024			
Bhc - Delta					< .0293			
Bhc - Gamma (lindane)					< .0507			
Endosulfan I					< .023			
Endrin Aldehyde					< .0285			
Heptachlor					< .0423			
Isodrin					< .0562			
PAL SEMIVOLATILE ORGANICS (µg/L)								
Bis(2-ethylhexyl) Phthalate	< 4.8		< 4.8		< 4.8		< 4.8	

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-09X 09/20/94	CSW-94-09X 09/20/94 (filtered)	CSW-94-10X 09/20/94	CSW-94-10X 09/20/94 (filtered)	CSW-94-11X 09/21/94	CSW-94-11X 09/21/94 (filtered)	CSW-94-12X 09/21/94	CSW-94-12X 09/21/94 (filtered)
PAL WET CHEMISTRY								
Alkalinity	45000		46000		41000		49000	
Chloride	33000		33000		33000		33000	
Sulfate								
Total Hardness	67600		67600		67600		68400	
Total Suspended Solids	< 4000		< 4000		6000		37000	
OTHER								
Total Organic Carbon (µg/L)								

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-13X 09/22/94	CSW-94-13X 09/22/94 (filtered)	CSW-94-14X 09/21/94	CSW-94-14X 09/22/94 (filtered)	CSW-94-16X 09/22/94	CSW-94-16X 09/21/94 (filtered)	CSW-94-17X 09/22/94	CSW-94-17X 09/22/94 (filtered)
PAL METALS (µg/L)								
Aluminum	< 141	< 141 F	7740	< 141 F	501	< 141 F	< 141	< 141 F
Antimony	< 3.03	2.95 F	< 3.03	< 3.03 F	< 3.03	< 3.03 F	< 3.03	2.95 F
Arsenic	3.84	3.3 F	8.42	< 2.54 F	15.8	< 2.54 F	3.52	< 2.54 F
Barium	8.63	8.15 F	107	11.6 F	46.9	12.5 F	8.95	8.28 F
Beryllium	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F
Cadmium	< 4.01	< 4.01 F	9.74	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F
Calcium	24000	24000 F	22300	7300 F	18000	17200 F	22900	22800 F
Chromium	< 6.02	< 6.02 F	14	< 6.02 F	< 6.02	< 6.02 F	< 6.02	< 6.02 F
Cobalt	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F
Copper	< 8.09	< 8.09 F	60.5	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F
Iron	423	115 F	7800	< 38.8 F	6080	438 F	474	249 F
Lead	< 1.26	< 1.26 F	140	1.41 F	3.36	< 1.26 F	< 1.26	< 1.26 F
Magnesium	3450	3460 F	2020	611 F	3420	3300 F	3270	3270 F
Manganese	101	96.5 F	60	7.88 F	4480	217 F	102	90 F
Mercury	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F
Nickel	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F
Potassium	2110	2010 F	2860	1540 F	2500	2540 F	1500	1460 F
Selenium	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F
Sodium	19600	19700 F	44700	46200 F	32800	32800 F	20500	20600 F
Vanadium	< 11	< 11 F	16.4	< 11 F	< 11	< 11 F	< 11	< 11 F
Zinc	< 21.1	< 21.1 F	240	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F
PAL PESTICIDES/PCBS (µg/L)								
4,4'-ddd	< .0233							
4,4'-ddt	< .034							
Bhc - Alpha	< .0385							
Bhc - Beta	< .024							
Bhc - Delta	< .0293							
Bhc - Gamma (lindane)	< .0507							
Endosulfan I	< .023							
Endrin Aldehyde	< .0285							
Heptachlor	< .0423							
Isodrin	< .0562							
PAL SEMIVOLATILE ORGANICS (µg/L)								
Bis(2-ethylhexyl) Phthalate	< 4.8		< 4.8		< 4.8		< 4.8	

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-13X 09/22/94	CSW-94-13X 09/22/94 (filtered)	CSW-94-14X 09/22/94	CSW-94-14X 09/22/94 (filtered)	CSW-94-16X 09/22/94	CSW-94-16X 09/22/94 (filtered)	CSW-94-17X 09/22/94	CSW-94-17X 09/22/94 (filtered)
PAL WET CHEMISTRY								
Alkalinity	51000		13000		33000		47000	
Chloride	33000		55000		55000		33000	
Sulfate								
Total Hardness	71600		57200		62400		67200	
Total Suspended Solids	< 4000		212000		146000		9000	
OTHER								
Total Organic Carbon ($\mu g/L$)								

NOTES:
$\mu g/L$ = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-18X 09/22/94	CSW-94-18X 09/22/94 (filtered)	CSW-94-19X 09/22/94	CSW-94-19X 09/22/94 (filtered)	CSW-94-20X 09/22/94	CSW-94-20X 09/22/94 (filtered)	CSW-94-26X 09/20/94	CSW-94-26X 09/20/94 (filtered)
PAL METALS (µg/L)								
Aluminum	< 141	< 141 F	< 141	< 141 F	167	< 141 F	< 141	< 141 F
Antimony	< 3.03	3.04 F	< 3.03	< 3.03 F	< 3.03	< 3.03 F	< 3.03	< 3.03 F
Arsenic	2.98	< 2.54 F	3.73	< 2.54 F	< 2.54	< 2.54 F	< 2.54	< 2.54 F
Barium	11.5	12.5 F	8.95	8.18 F	16.8	16.5 F	12.8	9.44 F
Beryllium	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F
Cadmium	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F
Calcium	18400	17500 F	22300	22500 F	21300	21100 F	17300	16900 F
Chromium	< 6.02	< 6.02 F	< 6.02	< 6.02 F	< 6.02	< 6.02 F	< 6.02	< 6.02 F
Cobalt	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F
Copper	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F
Iron	305	873 F	562	105 F	1090	172 F	804	150 F
Lead	< 1.26	< 1.26 F	< 1.26	< 1.26 F	1.41	< 1.26 F	< 1.26	< 1.26 F
Magnesium	3200	3300 F	3200	3230 F	2820	2810 F	2900	2870 F
Manganese	278	442 F	128	86.8 F	119	108 F	613	222 F
Mercury	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F
Nickel	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F
Potassium	2040	2200 F	1580	1830 F	2620	2160 F	1730	1850 F
Selenium	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F
Sodium	29100	32100 F	19900	20200 F	21200	20900 F	22900	22600 F
Vanadium	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F
Zinc	< 21.1	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F
PAL PESTICIDES/PCBS (µg/L)								
4,4'-ddd	< .0233				< .0233			
4,4'-ddt	< .034				< .034			
Bhc - Alpha	< .0385				< .0385			
Bhc - Beta	< .024				< .024			
Bhc - Delta	< .0293				< .0293			
Bhc - Gamma (lindane)	< .0507				< .0507			
Endosulfan I	< .023				< .023			
Endrin Aldehyde	< .0285				< .0285			
Heptachlor	< .0423				< .0423			
Isodrin	< .0562				< .0562			
PAL SEMIVOLATILE ORGANICS (µg/L)								
Bis(2-ethylhexyl) Phthalate	11		< 4.8		< 4.8		< 4.8	

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-18X 09/22/94	CSW-94-18X 09/22/94 (filtered)	CSW-94-19X 09/22/94	CSW-94-19X 09/22/94 (filtered)	CSW-94-20X 09/22/94	CSW-94-20X 09/22/94 (filtered)	CSW-94-26X 09/20/94	CSW-94-26X 09/20/94 (filtered)
PAL WET CHEMISTRY								
Alkalinity	34000		47000		22000		36000	
Chloride	66000		33000		66000		66000	
Sulfate								
Total Hardness	56400		68000		61600		54400	
Total Suspended Solids	< 4000		< 4000		131000		< 4000	
OTHER								
Total Organic Carbon (µg/L)								

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-27X 09/20/94	CSW-94-27X 09/20/94 (filtered)	CSW-94-28X 09/22/94	CSW-94-28X 09/22/94 (filtered)	CSW-94-31X 09/21/94	CSW-94-31X 09/21/94 (filtered)	CSW-94-32X 09/21/94	CSW-94-32X 09/21/94 (filtered)
PAL METALS (µg/L)								
Aluminum	< 141	< 141 F	< 141	< 141 F	3150	< 141 F	< 141	< 141 F
Antimony	< 3.03	< 3.03 F	< 3.03	3.12 F	< 3.03	< 3.03 F	< 3.03	2.95 F
Arsenic	< 2.54	< 2.54 F	< 2.54	< 2.54 F	79.3	< 2.54 F	< 2.54	< 2.54 F
Barium	9.54	8.18 F	8.18	8.56 F	179	7.01 F	7.4	8.18 F
Beryllium	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F
Cadmium	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F
Calcium	16700	16400 F	17800	17500 F	19700	16400 F	16400	16400 F
Chromium	< 6.02	< 6.02 F	< 6.02	< 6.02 F	6.33	< 6.02 F	< 6.02	< 6.02 F
Cobalt	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F
Copper	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F
Iron	381	109 F	323	151 F	40300	200 F	490	247 F
Lead	< 1.26	< 1.26 F	3.15	< 1.26 F	32.8	10.6 F	5.97	< 1.26 F
Magnesium	2800	2790 F	3050	3020 F	3640	2810 F	2790	2820 F
Manganese	209	179 F	181	132 F	6320	151 F	177	171 F
Mercury	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F
Nickel	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F
Potassium	2080	1910 F	1650	1750 F	2720	1530 F	1760	1800 F
Selenium	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F
Sodium	22300	22200 F	26100	25900 F	23000	23000 F	22500	22600 F
Vanadium	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F
Zinc	< 21.1	< 21.1 F	< 21.1	< 21.1 F	83	< 21.1 F	< 21.1	< 21.1 F
PAL PESTICIDES/PCBS (µg/L)								
4,4'-ddd	< .0233						< .0233	
4,4'-ddt	< .034						< .034	
Bhc - Alpha	< .0385						< .0385	
Bhc - Beta	< .024						< .024	
Bhc - Delta	< .0293						< .0293	
Bhc - Gamma (lindane)	< .0507						< .0507	
Endosulfan I	< .023						< .023	
Endrin Aldehyde	< .0285						< .0285	
Heptachlor	< .0423						< .0423	
Isodrin	< .0562						< .0562	
PAL SEMIVOLATILE ORGANICS (µg/L)								
Bis(2-ethylhexyl) Phthalate	< 4.8		< 4.8		< 4.8		< 4.8	

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-27X 09/20/94	CSW-94-27X 09/20/94 (filtered)	CSW-94-28X 09/22/94	CSW-94-28X 09/22/94 (filtered)	CSW-94-31X 09/21/94	CSW-94-31X 09/21/94 (filtered)	CSW-94-32X 09/21/94	CSW-94-32X 09/21/94 (filtered)
PAL WET CHEMISTRY								
Alkalinity	35000		35000		32000		35000	
Chloride	33000		66000		66000		66000	
Sulfate								
Total Hardness	51600		56000		63200		51200	
Total Suspended Solids	< 4000		< 4000		380000		4000	
OTHER								
Total Organic Carbon (µg/L)								

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-33X 09/21/94	CSW-94-33X 09/21/94 (filtered)	CSW-94-34X 09/21/94	CSW-94-34X 09/21/94 (filtered)	CSW-94-35X 09/22/94	CSW-94-35X 09/22/94 (filtered)	SSW-95-09H 07/10/95
PAL METALS (µg/L)							
Aluminum	1370	< 141 F	374	< 141 F	< 141	< 141 F	< 112
Antimony	< 3.03	2.77 F	< 3.03	< 3.03 F	< 3.03	4.11 F	< 60
Arsenic	40	< 2.54 F	5.22	< 2.54 F	< 2.54	< 2.54 F	8.94 M
Barium	89.9	7.59 F	13.3	7.98 F	9.35	8.37 F	18.1
Beryllium	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F	1.21
Cadmium	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 6.78
Calcium	17800	16300 F	16400	15500 F	11200	11200 F	24200
Chromium	19.7	< 6.02 F	6.26	< 6.02 F	< 6.02	< 6.02 F	< 16.8
Cobalt	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F	< 25
Copper	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 8.09	< 8.09 F	< 18.8
Iron	19200	247 F	2120	429 F	389	195 F	1700
Lead	12.9	2.06 F	4.56	< 1.26 F	2.71	< 1.26 F	< 4.47 MP
Magnesium	3210	2790 F	2830	2660 F	1300	1310 F	3620
Manganese	1870	148 F	211	157 F	46.2	39.1 F	196
Mercury	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F	< .1
Nickel	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 32.1
Potassium	2150	1860 F	2020	1960 F	1340	801 F	< 1240
Selenium	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 2.53
Sodium	23000	22500 F	22600	22000 F	24700	24900 F	20300
Vanadium	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F	< 27.6
Zinc	29.6	< 21.1 F	< 21.1	< 21.1 F	< 21.1	< 21.1 F	< 18 MI
PAL PESTICIDES/PCBS (µg/L)							
4,4'-ddd			< .0233				< .0081
4,4'-ddt			< .034				< .0025
Bhc - Alpha			< .0385				.0182 C
Bhc - Beta			< .024				< .0099
Bhc - Delta			< .0293				< .0034
Bhc - Gamma (lindane)			< .0507				< .0025 N
Endosulfan I			< .023				< .0025 N
Endrin Aldehyde			< .0285				< .0504
Heptachlor			< .0423				.0034 U
Isodrin			< .0562				< .0025
PAL SEMIVOLATILE ORGANICS (µg/L)							
Bis(2-ethylhexyl) Phthalate	< 4.8		< 4.8		< 4.8		< 7.7 V

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-33X 09/21/94	CSW-94-33X 09/21/94 (filtered)	CSW-94-34X 09/21/94	CSW-94-34X 09/21/94 (filtered)	CSW-94-35X 09/22/94	CSW-94-35X 09/22/94 (filtered)	SSW-95-09H 07/10/95
PAL WET CHEMISTRY							
Alkalinity	33000		27000		19000		46600 F
Chloride	33000		33000		33000		42000
Sulfate							13000
Total Hardness	52000		50400		31600		73900
Total Suspended Solids	192000		352000		< 4000		< 4000
OTHER							
Total Organic Carbon (µg/L)							3430

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	SSW-95-09H 07/10/95		SSW-95-09I 07/10/95		SSW-95-09I 07/10/95 (filtered)		SSW-95-09J 07/10/95		SSW-95-09J 07/10/95 (filtered)		SSW-95-09J 07/10/95 (duplicate)		SSW-95-09J 07/10/95 (duplicate/filtered)	
PAL METALS (µg/L)														
Aluminum	< 112	F	< 112		< 112	F	< 112		< 112	F	< 112	D	< 112	DF
Antimony	< 60	F	< 60		< 60	F	< 60		< 60	F	< 60	D	< 60	DF
Arsenic	4.98	FM	19.9	M	< 2.35	FM	11.6	M	3.89	FM	4.38	DM	2.54	DFM
Barium	16	F	21.6		18.3	F	7.05		7.75	F	8.22	D	7.05	DF
Beryllium	< 1.12	F	1.47		1.39	F	1.19		1.27	F	1.31	D	1.21	DF
Cadmium	< 6.78	F	< 6.78		< 6.78	F	< 6.78		< 6.78	F	< 6.78	D	< 6.78	DF
Calcium	24100	F	30800		29000	F	23800		25900	F	26900	D	24300	DF
Chromium	< 16.8	F	< 16.8		< 16.8	F	< 16.8		< 16.8	F	< 16.8	D	< 16.8	DF
Cobalt	< 25	F	< 25		< 25	F	< 25		< 25	F	< 25	D	< 25	DF
Copper	< 18.8	F	< 18.8		< 18.8	F	< 18.8		< 18.8	F	< 18.8	D	< 18.8	DF
Iron	437	F	3470		1830	F	< 77.5		167	F	178	D	< 77.5	DF
Lead	< 4.47	FMP	< 4.47	MP	< 4.47	FMP	< 4.47	MP	< 4.47	FMP	< 4.47	DMP	< 4.47	DFMP
Magnesium	3610	F	3400		3240	F	3580		3850	F	4010	D	3630	DF
Manganese	99.9	F	704		489	F	45.4		146	F	56	D	43.9	DF
Mercury	< .1	F	< .1		< .1	F	< .1		< .1	F	< .1	D	< .1	DF
Nickel	< 32.1	F	< 32.1		< 32.1	F	< 32.1		< 32.1	F	< 32.1	D	< 32.1	DF
Potassium	< 1240	F	1380		< 1240	F	< 1240		< 1240	F	< 1240	D	1340	DF
Selenium	< 2.53	F	< 2.53		< 2.53	F	< 2.53		< 2.53	F	< 2.53	D	< 2.53	DF
Sodium	20500	F	33300		31800	F	20300		21900	F	22600	D	20700	DF
Vanadium	< 27.6	F	< 27.6		< 27.6	F	< 27.6		< 27.6	F	< 27.6	D	< 27.6	DF
Zinc	< 18	FMI	23.8	MI	18.7	FMI	< 18	MI	< 18	FMI	< 18	DMI	< 18	DFMI
PAL PESTICIDES/PCBS (µg/L)														
4,4'-ddd			.00833	C			< .0081							
4,4'-ddt			< .0025				< .0025							
Bhc - Alpha			.021	C			< .0025							
Bhc - Beta			< .0099				< .0099							
Bhc - Delta			< .0034				.00862	U						
Bhc - Gamma (lindane)			.00318	UN			< .0025	N						
Endosulfan I			< .0025	N			< .0025	N						
Endrin Aldehyde			< .0504				.0921	U						
Heptachlor			.00358	U			.0032	U						
Isodrin			< .0025				.00848	BU						
PAL SEMIVOLATILE ORGANICS (µg/L)														
Bis(2-ethylhexyl) Phthalate			< 7.7	V			< 7.7	V			< 7.7	VD		

LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	SSW-95-09H 07/10/95	SSW-95-09I 07/10/95	SSW-95-09I 07/10/95 (filtered)	SSW-95-09J 07/10/95	SSW-95-09J 07/10/95 (filtered)	SSW-95-09J 07/10/95 (duplicate)	SSW-95-09J 07/10/95 (duplicate/filtered)
PAL WET CHEMISTRY							
Alkalinity		70800 FV		44200 FV			
Chloride		57000 V		42000 V			
Sulfate		10100 V		14000 V		82000 D	
Total Hardness		89500					
Total Suspended Solids		< 4000		< 4000			
OTHER							
Total Organic Carbon (µg/L)		3650		1340		1150 D	

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-04X 09/19/94	CSW-94-04X 09/19/94 (filtered)	CSW-94-05X 09/19/94	CSW-94-05X 09/19/94 (duplicate)	CSW-94-05X 09/19/94 (filtered)	CSW-94-05X 09/19/94 (duplicate/filtered)	CSW-94-06X 09/19/94	CSW-94-06X 09/19/94 (filtered)
PAL METALS (µg/L)								
Aluminum	1070	< 141 F	1970	4740 D	< 141 F	< 141 DF	208	< 141 F
Antimony	< 3.03	< 3.03 F	< 3.03	< 3.03 D	< 3.03 F	< 3.03 DF	< 3.03	< 3.03 F
Arsenic	< 2.54	< 2.54 F	5.54	14.1 D	< 2.54 F	< 2.54 DF	< 2.54	< 2.54 F
Barium	42.7	27.8 F	65	136 D	35.4 F	33.8 DF	29	26.7 F
Beryllium	< 5	< 5 F	< 5	< 5 D	< 5 F	< 5 DF	< 5	< 5 F
Cadmium	< 4.01	< 4.01 F	< 4.01	< 4.01 D	< 4.01 F	< 4.01 DF	< 4.01	< 4.01 F
Calcium	11000	10600 F	12400	14500 D	11700 F	11400 DF	11600	11800 F
Chromium	< 6.02	< 6.02 F	< 6.02	< 6.02 D	< 6.02 F	< 6.02 DF	< 6.02	< 6.02 F
Cobalt	< 25	< 25 F	< 25	44.3 D	< 25 F	< 25 DF	< 25	< 25 F
Copper	< 8.09	< 8.09 F	< 8.09	8.94 D	< 8.09 F	< 8.09 DF	< 8.09	< 8.09 F
Iron	6680	< 38.8 F	5770	14000 D	124 F	107 DF	679	124 F
Lead	< 1.26	< 1.26 F	10.1	27.3 D	< 1.26 F	< 1.26 DF	3.58	< 1.26 F
Magnesium	1290	1260 F	1470	1770 D	1400 F	1370 DF	1460	1440 F
Manganese	1450	195 F	1940	6050 D	385 F	336 DF	323	224 F
Mercury	< .243	< .243 F	< .243	< .243 D	< .243 F	< .243 DF	< .243	< .243 F
Nickel	< 34.3	< 34.3 F	< 34.3	42.1 D	< 34.3 F	< 34.3 DF	< 34.3	< 34.3 F
Potassium	1360	1560 F	1820	2500 D	1710 F	1800 DF	1830	1630 F
Selenium	< 3.02	< 3.02 F	< 3.02	3.3 D	< 3.02 F	< 3.02 DF	< 3.02	< 3.02 F
Sodium	15000	15000 F	15900	15800 D	16500 F	15800 DF	19400	19800 F
Vanadium	< 11	< 11 F	< 11	< 11 D	< 11 F	< 11 DF	< 11	< 11 F
Zinc	33.9	< 21.1 F	112	187 D	< 21.1 F	< 21.1 DF	< 21.1	< 21.1 F
PAL PESTICIDES/PCBS (µg/L)								
DDD								
DDT								
Bhc - Alpha								
Bhc - Beta								
Bhc - Delta								
Bhc - Gamma (lindane)								
Endosulfan I								
Endrin Aldehyde								
Heptachlor								
Isodrin								
PAL SEMIVOLATILE ORGANICS (µg/L)								
Bis(2-ethylhexyl) Phthalate	10		< 4.8	6.1 D			4.5	

STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-04X 09/19/94	CSW-94-04X 09/19/94 (filtered)	CSW-94-05X 09/19/94	CSW-94-05X 09/19/94 (duplicate)	CSW-94-05X 09/19/94 (filtered)	CSW-94-05X 09/19/94 (duplicate/filtered)	CSW-94-06X 09/19/94	CSW-94-06X 09/19/94 (filtered)
PAL WET CHEMISTRY								
Alkalinity	15000		13000	13000 D			18000	
Chloride	27400		31800	31800 D			33000	
Sulfate								
Total Hardness	32400		37600	48000 D			34800	
Total Suspended Solids	9000		9000	21000 D			10000	
OTHER								
Total Organic Carbon (µg/L)								

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-07X 09/19/94	CSW-94-07X 09/19/94 (filtered)	SW-94-21X 09/20/94	CSW-94-21X 09/20/94 (filtered)	SW-94-24X 09/20/94	CSW-94-24X 09/20/94 (filtered)	CSW-94-30X 09/21/94	CSW-94-30X 09/21/94 (filtered)
PAL METALS (µg/L)								
Aluminum	< 141	< 141 F	930	< 141 F	710	< 141 F	74600	< 141 F
Antimony	< 3.03	< 3.03 F	< 3.03	< 3.03 F	< 3.03	3.66 F	7.68	< 3.03 F
Arsenic	< 2.54	< 2.54 F	14	11.4 F	19.3	7.78 F	93.2	3.09 F
Barium	25.9	24.9 F	18	12 F	52.5	47.1 F	387	14.5 F
Beryllium	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F	< 5	< 5 F
Cadmium	< 4.01	< 4.01 F	< 4.01	< 4.01 F	< 4.01	< 4.01 F	27	< 4.01 F
Calcium	11600	11500 F	7650	7290 F	8310	8490 F	38800	14400 F
Chromium	< 6.02	< 6.02 F	< 6.02	< 6.02 F	< 6.02	< 6.02 F	187	< 6.02 F
Cobalt	< 25	< 25 F	< 25	< 25 F	< 25	< 25 F	75	< 25 F
Copper	< 8.09	< 8.09 F	< 8.09	< 8.09 F	8.97	< 8.09 F	194	< 8.09 F
Iron	332	115 F	3710	1680 F	6320	158 F	126000	3060 F
Lead	1.52	< 1.26 F	20.6	1.52 F	18.2	2.93 F	370	1.41 F
Magnesium	1430	1410 F	798	517 F	1450	1300 F	29600	2570 F
Manganese	226	204 F	350	324 F	1190	973 F	4250	920 F
Mercury	< .243	< .243 F	< .243	< .243 F	< .243	< .243 F	.426	< .243 F
Nickel	< 34.3	< 34.3 F	< 34.3	< 34.3 F	< 34.3	< 34.3 F	185	< 34.3 F
Potassium	1780	1730 F	1570	1250 F	2080	1710 F	14000	2250 F
Selenium	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F	< 3.02	< 3.02 F
Sodium	19000	19000 F	22500	22000 F	18000	18600 F	24000	22300 F
Vanadium	< 11	< 11 F	< 11	< 11 F	< 11	< 11 F	162	< 11 F
Zinc	< 21.1	< 21.1 F	61.2	42.9 F	280	277 F	935	< 21.1 F
PAL PESTICIDES/PCBS (µg/L)								
DDD								
DDT								
Bhc - Alpha								
Bhc - Beta								
Bhc - Delta								
Bhc - Gamma (lindane)								
Endosulfan I								
Endrin Aldehyde								
Heptachlor								
Isodrin								
PAL SEMIVOLATILE ORGANICS (µg/L)								
Bis(2-ethylhexyl) Phthalate	< 4.8		< 4.8		< 4.8		< 4.8	

STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	CSW-94-07X 09/19/94	CSW-94-07X 09/19/94 (filtered)	SW-94-21X 09/20/94	CSW-94-21X 09/20/94 (filtered)	SW-94-24X 09/20/94	CSW-94-24X 09/20/94 (filtered)	SW-94-30X 09/21/94	CSW-94-30X 09/21/94 (filtered)
PAL WET CHEMISTRY								
Alkalinity	17000		24000		16000		30000	
Chloride	33000		28500		18700		33000	
Sulfate								
Total Hardness	34000		20000		27200		92400	
Total Suspended Solids	< 4000		31000		36000		3950000	
OTHER								
Total Organic Carbon (µg/L)								

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE		SSW-95-09K 07/10/95			SSW-95-09K 07/10/95 (duplicate)			SSW-95-09K 07/10/95 (filtered)	
PAL METALS (µg/L)									
Aluminum		223					<	112	F
Antimony	<	60					<	60	F
Arsenic		63.4	M					26.7	FM
Barium		30.5						25.1	F
Beryllium		1.15						1.15	F
Cadmium	<	6.78					<	6.78	F
Calcium		22500						22500	F
Chromium	<	16.8					<	16.8	F
Cobalt	<	25					<	25	F
Copper	<	18.8					<	18.8	F
Iron		23500						9250	F
Lead	<	4.47	MP				<	4.47	FMP
Magnesium		2300						2290	F
Manganese		845						835	F
Mercury	<	.1					<	.1	F
Nickel	<	32.1					<	32.1	F
Potassium		1610						1420	F
Selenium	<	2.53					<	2.53	F
Sodium		27900						28000	F
Vanadium	<	27.6					<	27.6	F
Zinc	<	18	MI				<	18	FMI
PAL PESTICIDES/PCBS (µg/L)									
DDD	<	.0081			.0178	DC			
DDT	<	.0025			.00314	DU			
Bhc - Alpha		.00444	C		.00479	DU			
Bhc - Beta	<	.0099			.0119	DU			
Bhc - Delta		.0037	U	<	.0034	D			
Bhc - Gamma (lindane)		.00423	UN		.00553	DUN			
Endosulfan I	<	.0025	N		.00436	DUN			
Endrin Aldehyde		.0639	U	<	.0504	D			
Heptachlor	<	.0025			.0034	DU			
Isodrin	<	.0025		<	.0025	D			
PAL SEMIVOLATILE ORGANICS (µg/L)									
Bis(2-ethylhexyl) Phthalate	<	7.7	V						

STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

LOWER COLD SPRING BROOK SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	SSW-95-09K 07/10/95		SSW-95-09K 07/10/95 (duplicate)	SSW-95-09K 07/10/95 (filtered)
PAL WET CHEMISTRY				
Alkalinity	53100	FV		
Chloride	39000	V		
Sulfate	5640	V		
Total Hardness	64500			
Total Suspended Solids	< 59000			
OTHER				
Total Organic Carbon (μg/L)	13300			

NOTES:
μg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

HYDROGEOLOGIC DATA

F-1 IN-SITU HYDRAULIC CONDUCTIVITY TESTING

F-2 HYDRAULIC GRADIENT AND GROUNDWATER FLOW VELOCITY CALCULATIONS

IN-SITU HYDRAULIC CONDUCTIVITY TESTING

APPENDIX F-1 HYDRAULIC CONDUCTIVITY TEST RESULTS

ABB-ES performed rising head slug tests on monitoring wells installed during the AOC 57 RI in November 1995 and January 1997. This appendix discusses the analytical procedure and presents estimated values of hydraulic conductivity. The test methodology is presented in Subsections 4.8.2 of Volume I of the Fort Devens POP (ABB-ES, 1995a). Field data from all tests were analyzed to estimate hydraulic conductivity using a derivation of the method of Hvorslev (1951)[1] and the method of Bouwer and Rice (1976)[2].

The form of the Hvorslev equation that was used relates the hydraulic conductivity, K, of an unconfined aquifer to the well geometry and the rate of head recovery by:

$$-K = \left[\frac{\mathrm{Log}(H_1)-\mathrm{Log}(H_2)}{t_1 - t_2}\right] \frac{r^2\ \mathrm{Log}(L / R)}{2L}$$

Parameters in this equation included: r (radius of the well casing), R (radius of the borehole), L (length of the aquifer tested), as well as time (t) and water level (H) data expressed as drawdown. Log values are log base ten. Test data were also analyzed using AQTESOLV™[3], an aquifer test analysis program by Geraghty Miller, Inc. AQTESOLV™ utilizes the Bouwer and Rice method for estimating hydraulic conductivities in unconfined aquifers.

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[1]Hvorslev, M.J., 1951. "Time Lag and Soil Permeability in Groundwater Observations;" U.S. Army Corps of Engineers, Waterways Experiment Station, Bulletin 36; Vicksburg, Mississippi.

[2]Bouwer, H. and R.C. Rice, 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells, Water Resources Research, Vol. 12, No. 3, pp 423-428.

[3]AQTESOLV, 1991 "ATESOLV, Aquifer Test Solver Version 1.00;" Geraghty and Miller Modeling Group; Reston, VA.

Estimates of hydraulic conductivity for the 15 wells/piezometers tested at AOC 57 range between 1.22×10^{-1} cm/sec and 4.22×10^{-4} cm/sec for the Bouwer and Rice method while the Hvorslev method yields values of 1.26×10^{-2} cm/sec to 4.28×10^{-5} cm/sec. Typically the Bouwer and Rice method provided hydraulic conductivity values which were greater than the values obtained with the Hvorslev equation.

The results of hydraulic conductivity testing are summarized in Table F-1. The data for each test are also provided. The information contained in this Appendix is organized as follows:

1) Table F-1, Summary of In-Situ Hydraulic Conductivity Test Results; input parameters used for AQTESOLV™ analyses;

2) AQTESOLV™ plots with computed hydraulic conductivity values;

3) A table of calculation of hydraulic conductivities using the Hvorslev Equation; and

4) Raw data and plots of data for Hvorslev analyses;

Static water levels in each well were generally referenced to zero with head stress being expressed as a positive change.

92021 S90 (1)

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM D McCabe / R. Lago
MONITORING WELL ID	57 M-95-01X	
DATE OF TEST	11/16/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000C 1K8 480	
TEST #	1	2
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	272872	
PSIG	10	
SCALE FACTOR	10.023	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	23.91	
WELL DEPTH (FT./TOC)	31.0	
XD DEPTH (FT.TOC)	29.8	
INITIAL XD REFERENCE	0.00	0.00
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT	11:23	11:30
TIME OF WL EQUILIBRATION		
NEW XD REFERENCE	0.00	0.00
START TIME OF TEST		
END TIME OF TEST		
NOTES:	3" Ø by 3' long bar stock PVC slug	

ABB Environmental Services, Inc.

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM
MONITORING WELL ID	5'7M-95-03X	D.McCabe / R. Lago
DATE OF TEST	11/17/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000C KB 480	1000C KB 480
TEST #	19	0
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	272872	
PSIG	10	
SCALE FACTOR	10.023	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	17.99 (PVC)	
WELL DEPTH (FT./TOC)	26.80 (PVC)	
XD DEPTH (FT.TOC)	25.0	
INITIAL XD REFERENCE	0.00	0.00
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT		
TIME OF WL EQUILIBRATION		
NEW XD REFERENCE	0.00	0.00
START TIME OF TEST		
END TIME OF TEST		
NOTES:		

Slug 3" Ø by 3' barstock PVC

ABB Environmental Services, Inc.

AQUIFER TESTING COMPLETION CHECKLIST

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AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM D McCabe / R. Lago
MONITORING WELL ID	57M-95-03X	57M-95-03X
DATE OF TEST	11/16/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000C KB 480	
TEST #	3	4
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	272872	
PSIG	10	
SCALE FACTOR	10.023	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	10.09	
WELL DEPTH (FT./TOC)	19.60	
XD DEPTH (FT.TOC)	19.0	
INITIAL XD REFERENCE	8.71	
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT	13:27	13:57
TIME OF WL EQUILIBRATION	13:48	14:10
NEW XD REFERENCE		
START TIME OF TEST		
END TIME OF TEST		
NOTES:	3" Ø by 3' bar stock	pvc slug

ABB Environmental Services, Inc.

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AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM D.McCah / R. Lago
MONITORING WELL ID	57M-95-04A	
DATE OF TEST	11/17/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000 C KB 480	
TEST #	17	18
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	272872	
PSIG	10	
SCALE FACTOR	10.023	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	2.85	
WELL DEPTH (FT./TOC)	13.0	
XD DEPTH (FT.TOC)	12	
INITIAL XD REFERENCE	8.63	
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT		
TIME OF WL EQUILIBRATION		
NEW XD REFERENCE	0.00	
START TIME OF TEST		
END TIME OF TEST		
NOTES:	3" Ø by 3' long	bar stock PVC slug

ABB Environmental Services, Inc.

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM D. McCabe / R. Lapp
MONITORING WELL ID	57M-95-04B	
DATE OF TEST	11/17/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000 C KB 480	
TEST #	15	16
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	272872	
PSIG	10	
SCALE FACTOR	10.023	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	3.69	
WELL DEPTH (FT./TOC)	31.0	
XD DEPTH (FT.TOC)	± 20.0	
INITIAL XD REFERENCE	16.0	
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT		
TIME OF WL EQUILIBRATION		
NEW XD REFERENCE		
START TIME OF TEST		
END TIME OF TEST		
NOTES:	3" Ø by 3' long bar	stock PVC slug

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM D McCabe / R. Lago
MONITORING WELL ID	57M-95-05X	
DATE OF TEST	11/16/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000C KB 480	
TEST #	9	10
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	272872	
PSIG	10	
SCALE FACTOR	10.033	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	15.11	
WELL DEPTH (FT./TOC)	22.2	
XD DEPTH (FT.TOC)	20	
INITIAL XD REFERENCE	4.93	
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT		
TIME OF WL EQUILIBRATION		
NEW XD REFERENCE		
START TIME OF TEST		
END TIME OF TEST		
NOTES:	3"ø by 3' long bar	stock PVC slug

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM D. McCabe / R. Lago
MONITORING WELL ID	57M-95-06X	
DATE OF TEST	11/16/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000C KB 480	
TEST #	5	6
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	272872	
PSIG	10	
SCALE FACTOR	10.023	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	13.28	
WELL DEPTH (FT./TOC)	24.50	
XD DEPTH (FT.TOC)	20	
INITIAL XD REFERENCE	6.86	
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT	14.35	
TIME OF WL EQUILIBRATION	14.38	
NEW XD REFERENCE		
START TIME OF TEST		
END TIME OF TEST		
NOTES:	Slug 3"Ø by 3' long	bar stock PVC

ABB Environmental Services, Inc.

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM D. McCabe / R. Lago
MONITORING WELL ID	57M-95-07X	
DATE OF TEST	11/16/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000 C KB 480	
TEST #	7	8
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	272872	
PSIG	10	
SCALE FACTOR	10.023	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	3.13 (pvc)	
WELL DEPTH (FT./TOC)	14.50	
XD DEPTH (FT.TOC)	12	
INITIAL XD REFERENCE	8.81	
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT		
TIME OF WL EQUILIBRATION		
NEW XD REFERENCE		
START TIME OF TEST		
END TIME OF TEST		
NOTES:	3 in ϕ by 3' long	bar-stock PVC slug

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AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM
		D. McCabe / R. Lago
MONITORING WELL ID	57M-95-08A	
DATE OF TEST	11/17/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000 C KB 480	
TEST #	12	13
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	273872	
PSIG	10	
SCALE FACTOR	10.023	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	2.78	
WELL DEPTH (FT./TOC)	14.1	
XD DEPTH (FT.TOC)	±12	
INITIAL XD REFERENCE	9.65	
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT		
TIME OF WL EQUILIBRATION		
NEW XD REFERENCE	0.0	
START TIME OF TEST		
END TIME OF TEST		
NOTES:	3"φ by 3' long bar	stock PVC slug

ABB Environmental Services, Inc.

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ______

SETUP	DATE	BY WHOM D. McCabe / R. Larp
MONITORING WELL ID	57M-95-08B	
DATE OF TEST	11/17/95	
TYPE OF TEST	Falling Head	Rising Head
HERMIT TYPE/SERIAL#	1000 C KB 480	
TEST #	11	12
DATA COLLECTION RATE	Log	
TRANSDUCER		
SERIAL #	272872	
PSIG	10	
SCALE FACTOR	10.023	
OFFSET	-0.01	
INPUT CHANNEL	1	
TEST DATA		
INPUT MODE (TOC/SUR)	Level	
STATIC WATER LEVEL (FT./TOC)	3.56 (PVC)	
WELL DEPTH (FT./TOC)	30.2	
XD DEPTH (FT.TOC)	± 20	
INITIAL XD REFERENCE	16.28	
SLUG DEPTH (FT./TOC)		
TIME OF SLUG PLACEMENT		
TIME OF WL EQUILIBRATION		
NEW XD REFERENCE	0.0	
START TIME OF TEST		
END TIME OF TEST		
NOTES:	3"Ø by 3' long bar	stock PVC slug

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. 00-01

SETUP	DATE	BY WHOM R. ROSTAD
MONITORING WELL ID	57M-96-09X	57M-96-09X
DATE OF TEST	1-16-~~96~~ 97	1-16-97
TYPE OF TEST	RISING HEAD	RISING HEAD
HERMIT TYPE/SERIAL#	1000C / 1KB-480	
TEST #	00 - 01	
DATA COLLECTION RATE	LOG 01	
TRANSDUCER		
SERIAL #	6638	
PSIG	30 PSI	
SCALE FACTOR	29.6952	
OFFSET	-0.0162	
INPUT CHANNEL	#1	
TEST DATA		
INPUT MODE (TOC/SUR)	TOC	
STATIC WATER LEVEL (FT./TOC)	16.61	
WELL DEPTH (FT./TOC)	25.69	
XD DEPTH (FT.TOC)	~~TOC~~ 25.1'	
INITIAL XD REFERENCE	0.0 (8.55)	
SLUG DEPTH (FT./TOC)	23.0	
TIME OF SLUG PLACEMENT	0930	
TIME OF WL EQUILIBRATION	0931	
NEW XD REFERENCE	RE-REF TO 0.0 (8.57)	
START TIME OF TEST	0933 / 0950	
END TIME OF TEST	0940 / 0954	
NOTES: TWO RISING HEAD TESTS PERFORMED		

ABB Environmental Services, Inc.

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. 02-03

SETUP	DATE	BY WHOM
MONITORING WELL ID	57M-96-10X	R. RUSTAD
DATE OF TEST	1.16.97	
TYPE OF TEST	RISING HEAD (2)	
HERMIT TYPE/SERIAL#	1000C / 1KB-480	
TEST #	02-03	
DATA COLLECTION RATE	LOG 01	
TRANSDUCER		
SERIAL #	6638	
PSIG	30 PSI	
SCALE FACTOR	29.6952	
OFFSET	-0.0162	
INPUT CHANNEL	# 1	
TEST DATA		
INPUT MODE (TOC/SUR)	TOC	
STATIC WATER LEVEL (FT./TOC)	6.45'	
WELL DEPTH (FT./TOC)	15.56	
XD DEPTH (FT.TOC)	14'	
INITIAL XD REFERENCE	0.0	
SLUG DEPTH (FT./TOC)	11'	
TIME OF SLUG PLACEMENT	1010	
TIME OF WL EQUILIBRATION	1030	
NEW XD REFERENCE	0.0 (REREFERENCE)	
START TIME OF TEST	1033 (T1) / 1100 (T2)	
END TIME OF TEST	1045 (T1) / 1110 (T2)	
NOTES: 2 RISING HEAD TESTS PERFORMED		

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AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ~~03-04~~/ (RR) 04-05

SETUP	DATE	BY WHOM
MONITORING WELL ID	57M-96-11X	R. Rustad
DATE OF TEST	1-16-97	
TYPE OF TEST	Rising Head	
HERMIT TYPE/SERIAL#	1000C / 1KB-480	
TEST #	(RR) ~~03-04~~ 04-05	
DATA COLLECTION RATE	Log 01	
TRANSDUCER		
SERIAL #	6638	
PSIG	30 PSI	
SCALE FACTOR	29.6952	
OFFSET	-0.0162	
INPUT CHANNEL	#1	
TEST DATA		
INPUT MODE (TOC/SUR)	TOC	
STATIC WATER LEVEL (FT./TOC)	3.30'	
WELL DEPTH (FT./TOC)	14.59	
XD DEPTH (FT.TOC)	13.00	
INITIAL XD REFERENCE	0.0	
SLUG DEPTH (FT./TOC)	8.0'	
TIME OF SLUG PLACEMENT	1115	
TIME OF WL EQUILIBRATION	1130	
NEW XD REFERENCE	0.0	
START TIME OF TEST	1133 / 1200	
END TIME OF TEST	1147 / 1212	
NOTES: 2 Rising Head Tests Performed		

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AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. 06-07

SETUP	DATE	BY WHOM
MONITORING WELL ID	57m. 96. 12x	R. Rustad
DATE OF TEST	1.16.97	
TYPE OF TEST	Rising Head	
HERMIT TYPE/SERIAL#	1000C / 1KB-480	
TEST #	06-07	
DATA COLLECTION RATE	Log 01	
TRANSDUCER		
SERIAL #	6638	
PSIG	30 PSI	
SCALE FACTOR	29.6952	
OFFSET	- 0.0162	
INPUT CHANNEL		
TEST DATA		
INPUT MODE (TOC/SUR)	TOC	
STATIC WATER LEVEL (FT./TOC)	4.39'	
WELL DEPTH (FT./TOC)	15.13'	
XD DEPTH (FT.TOC)	13'	
INITIAL XD REFERENCE	0.0	
SLUG DEPTH (FT./TOC)	10'	
TIME OF SLUG PLACEMENT	1220	
TIME OF WL EQUILIBRATION	1230	
NEW XD REFERENCE	0.0	
START TIME OF TEST	1231 / 1249	
END TIME OF TEST	1240 / 1257	
NOTES: 2 Rising Head	TESTS PERFORMED	

9202159D (R)

AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. 08-09

SETUP	DATE	BY WHOM
MONITORING WELL ID	57M-96-13X	R. RUSTAD
DATE OF TEST	1.16.97	
TYPE OF TEST	RISING HEAD	
HERMIT TYPE/SERIAL#	1000C / 1KB-4180	
TEST #	08-09	
DATA COLLECTION RATE	LOG 01	
TRANSDUCER		
SERIAL #	6638	
PSIG	30 PSI	
SCALE FACTOR	29.6952	
OFFSET	-0.0162	
INPUT CHANNEL	# 1	
TEST DATA		
INPUT MODE (TOC/SUR)	TOC	
STATIC WATER LEVEL (FT./TOC)	4.28'	
WELL DEPTH (FT./TOC)	14.89	
XD DEPTH (FT.TOC)	13'	
INITIAL XD REFERENCE	0.0	
SLUG DEPTH (FT./TOC)	9'	
TIME OF SLUG PLACEMENT	1310	
TIME OF WL EQUILIBRATION	1316	
NEW XD REFERENCE	0.0	
START TIME OF TEST	1320 / 1330	
END TIME OF TEST	1325 / 1335	
NOTES: 2 RISING HEAD	TESTS PERFORMED	

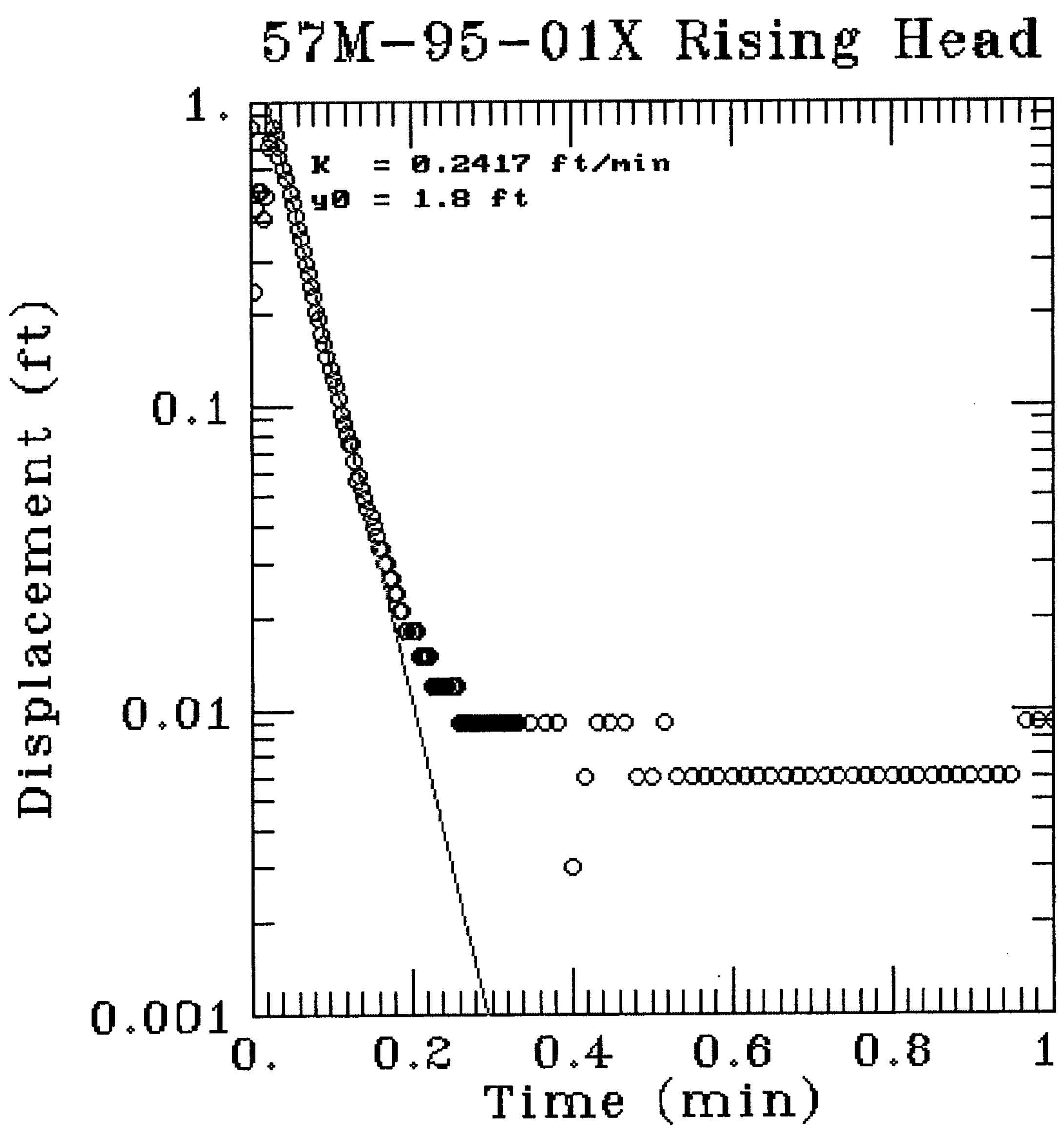
ABB Environmental Services, Inc.

TABLE F-1
SUMMARY OF HYDRAULIC CONDUCTIVITY TEST RESULTS
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Well ID	Well Diam. (in)	Screen Int. (feet, bgs)	Filter Pack Int. (feet, bgs)	Saturated Height (feet)	Rc (feet)	Rw (feet)	Le (feet)	Hw (feet)	Bouwer and Rice Hydraulic Cond. (ft/min)	Bouwer and Rice Hydraulic Cond. (cm/s)	Hvorslev Hydraulic Cond. (ft/min)	Hvorslev Hydraulic Cond. (cm/s)	Screened Geology (USCS)
57M-95-01X	4	19 to 29	13 to 29	7.09	0.29	0.46	7.09	7.09	2.40E-01	1.22E-01	2.49E-02	1.26E-02	SP
57M-95-02X	4	14 to 24	9 to 25	8.81	0.29	0.46	9.81	9.81	1.80E-01	9.14E-02	1.61E-02	8.17E-03	SW-SM
57M-95-03X	4	7 to 17	5 to 18	9.51	0.29	0.46	10.51	10.51	1.10E-02	5.59E-03	1.04E-03	5.27E-04	SW-SM
57M-95-04A	4	2.4 to 12.4	1.9 to 13	10.15	0.29	0.46	10.75	10.75	5.70E-02	2.90E-02	5.70E-03	2.90E-03	SP
57M-95-04B	4	18.5 to 28.5	13 to 30	27.31	0.17	0.46	17	28.81	2.30E-02	1.17E-02	5.77E-03	2.93E-03	SP
57M-95-05X	4	10 to 20	6 to 20	7.09	0.29	0.46	7.09	7.09	1.00E-01	5.08E-02	1.01E-02	5.14E-03	SW-SM
57M-95-06X	4	11.9 to 21.9	8 to 23	11.22	0.29	0.46	12.32	12.32	1.70E-02	8.64E-03	1.66E-03	8.42E-04	SP
57M-95-07X	4	3 to 13	2 to 14	11.37	0.29	0.46	12.37	12.37	6.70E-02	3.40E-02	7.00E-03	3.56E-03	SW-SM
57M-95-08A	4	3 to 13	2 to 15	11.32	0.29	0.46	13	13.32	8.30E-04	4.22E-04	8.42E-05	4.28E-05	SW-SM
57M-95-08B	4	18 to 28	13 to 30	26.64	0.17	0.46	17	28.64	7.40E-03	3.76E-03	2.02E-03	1.03E-03	SM
57M-96-09X	2	12.8 to 22.8	8 to 23	8.53	0.2	0.33	8.73	8.73	8.15E-03	4.14E-03	4.18E-04	2.13E-04	SP
57M-96-10X	2	3 to 13	2 to 13	9.03	0.2	0.33	9.03	9.03	1.36E-03	6.89E-04	4.39E-05	2.23E-05	SM
57M-96-11X	2	2 to 12	1.5 to 12	10.91	0.2	0.33	10.91	10.91	2.11E-03	1.07E-03	1.28E-04	6.53E-05	SM
57M-96-12X	2	2 to 12	1.5 to 12	10.66	0.2	0.33	10.66	10.66	2.60E-03	1.32E-03	1.20E-04	6.10E-05	SM
57M-96-13X	2	2 to 12	1.5 to 12	10.39	0.2	0.33	10.39	10.39	2.96E-03	1.50E-03	1.62E-04	8.24E-05	SM
								Geom. Mean	**1.34E-02**	**6.79E-03**	**1.18E-03**	**6.01E-04**	
								Average	4.80E-02	2.44E-02	5.02E-03	2.55E-03	

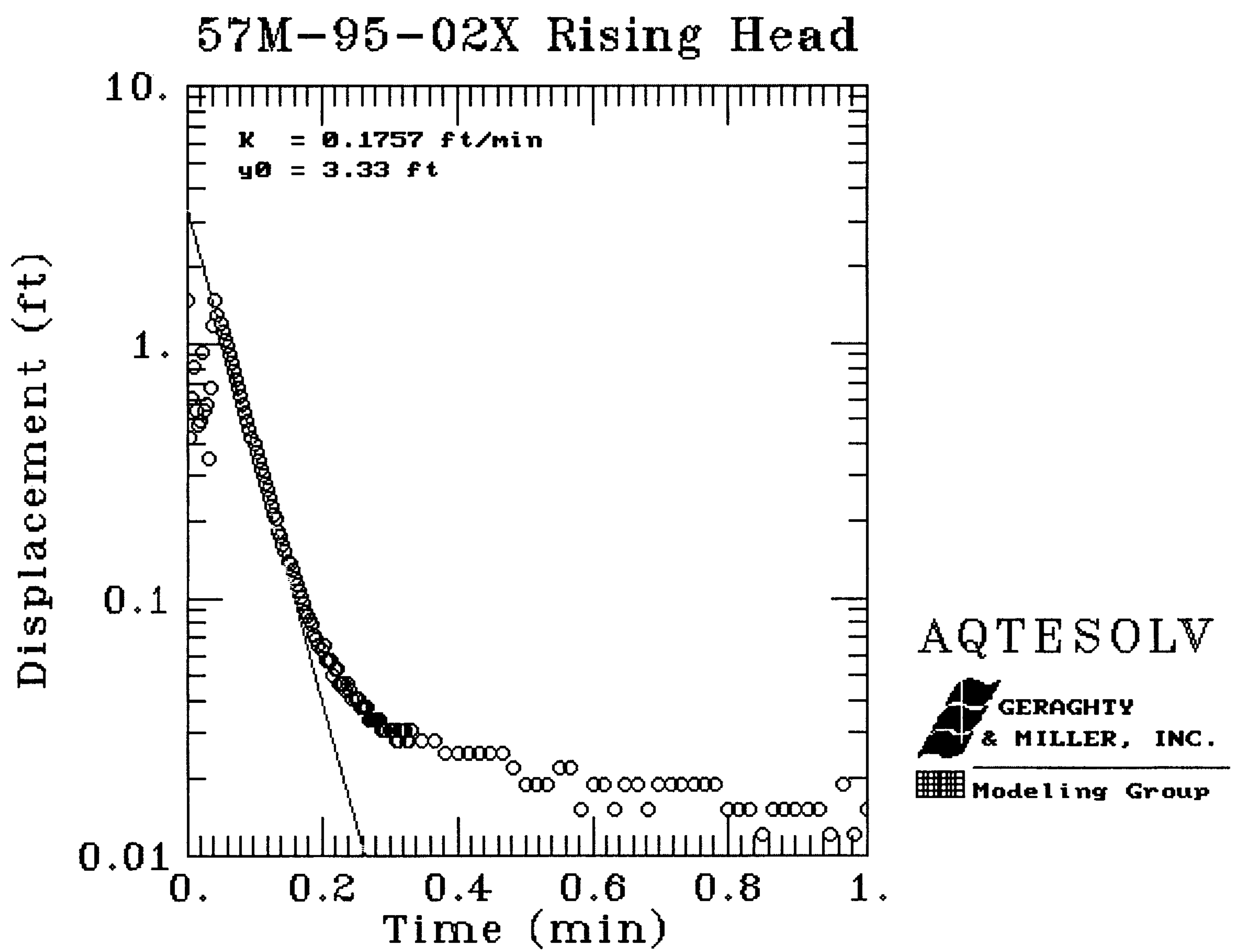
Notes:
Hydraulic conductivities for 1996-series wells are the average of results of two rising head tests.
Data analyzed using AQTESOLV (Bouwer & Rice Solution).
Rc = Well casing radius for fully saturated filterpacks and equivalent casing radius which accounts for filterpack resaturation at n=30% for partially saturated filterpacks.
Rw = Radius of borehole.
Le = Saturated length of filterpack.
Hw = Height of Water Column above filterpack bottom.
Saturated Height is height of water column measured in well.
All measurements in feet unless otherwise noted.



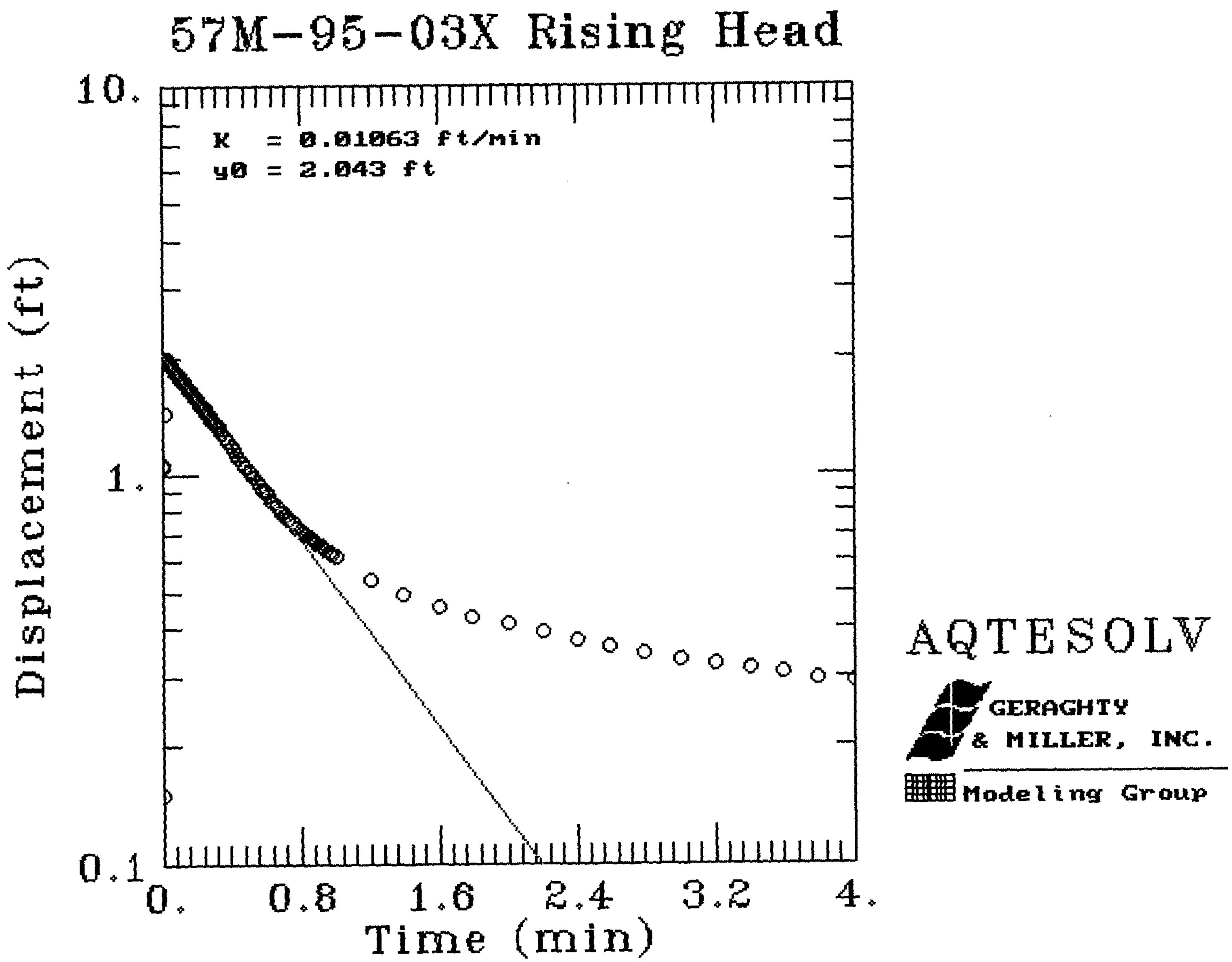
AQTESOLV

GERAGHTY & MILLER, INC.

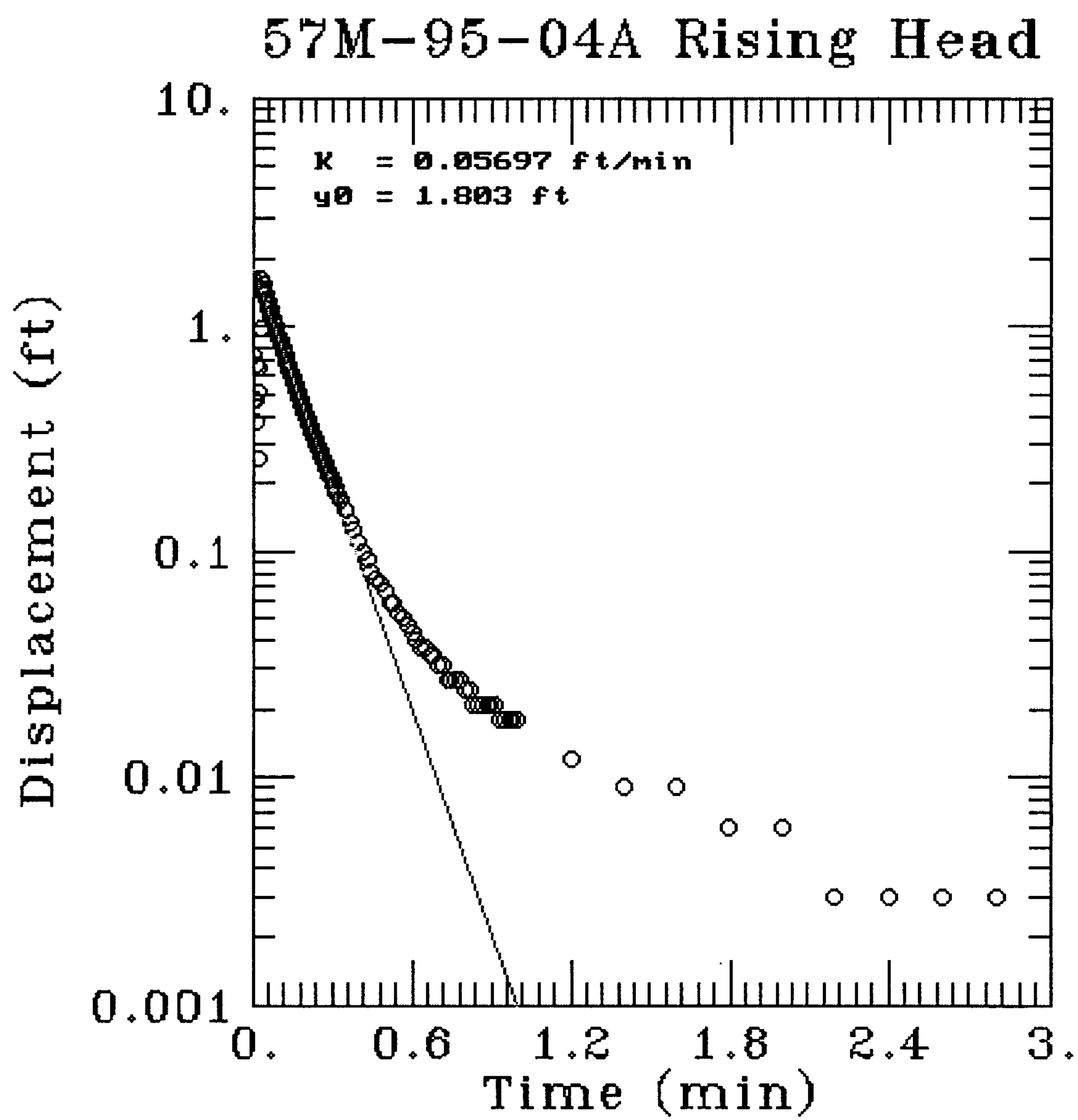
Modeling Group



57M-95-02X Rising Head
K = 0.1757 ft/min
y0 = 3.33 ft
10.
1.
0.1
0.01
Displacement (ft)
0.
0.2
0.4
0.6
0.8
1.
Time (min)
AQTESOLV
GERAGHTY
& MILLER, INC.
Modeling Group



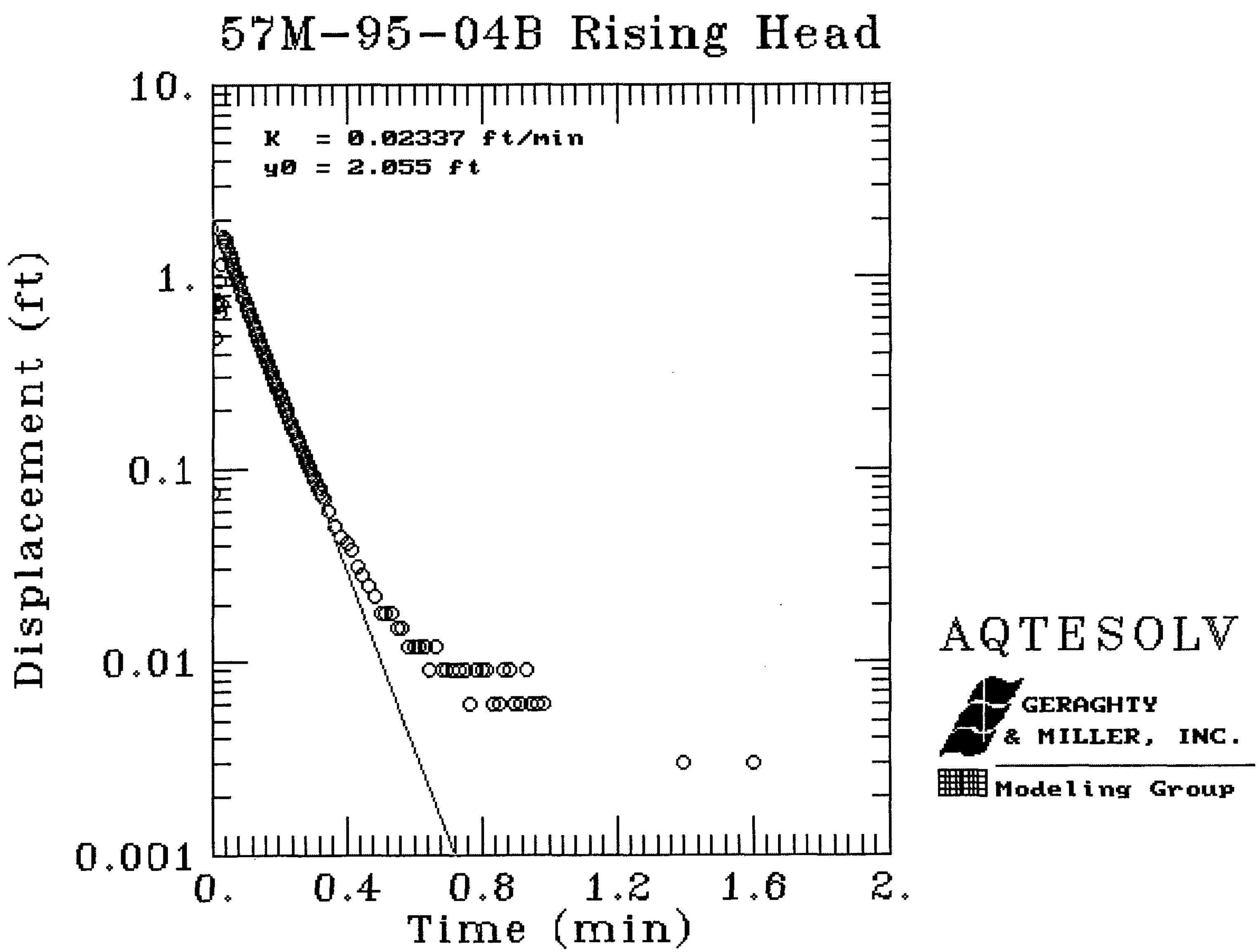
57M-95-03X Rising Head
K = 0.01063 ft/min
y0 = 2.043 ft
Displacement (ft)
10.
1.
0.1
0.
0.8
1.6
2.4
3.2
4.
Time (min)
AQTESOLV
GERAGHTY & MILLER, INC.
Modeling Group



AQTESOLV

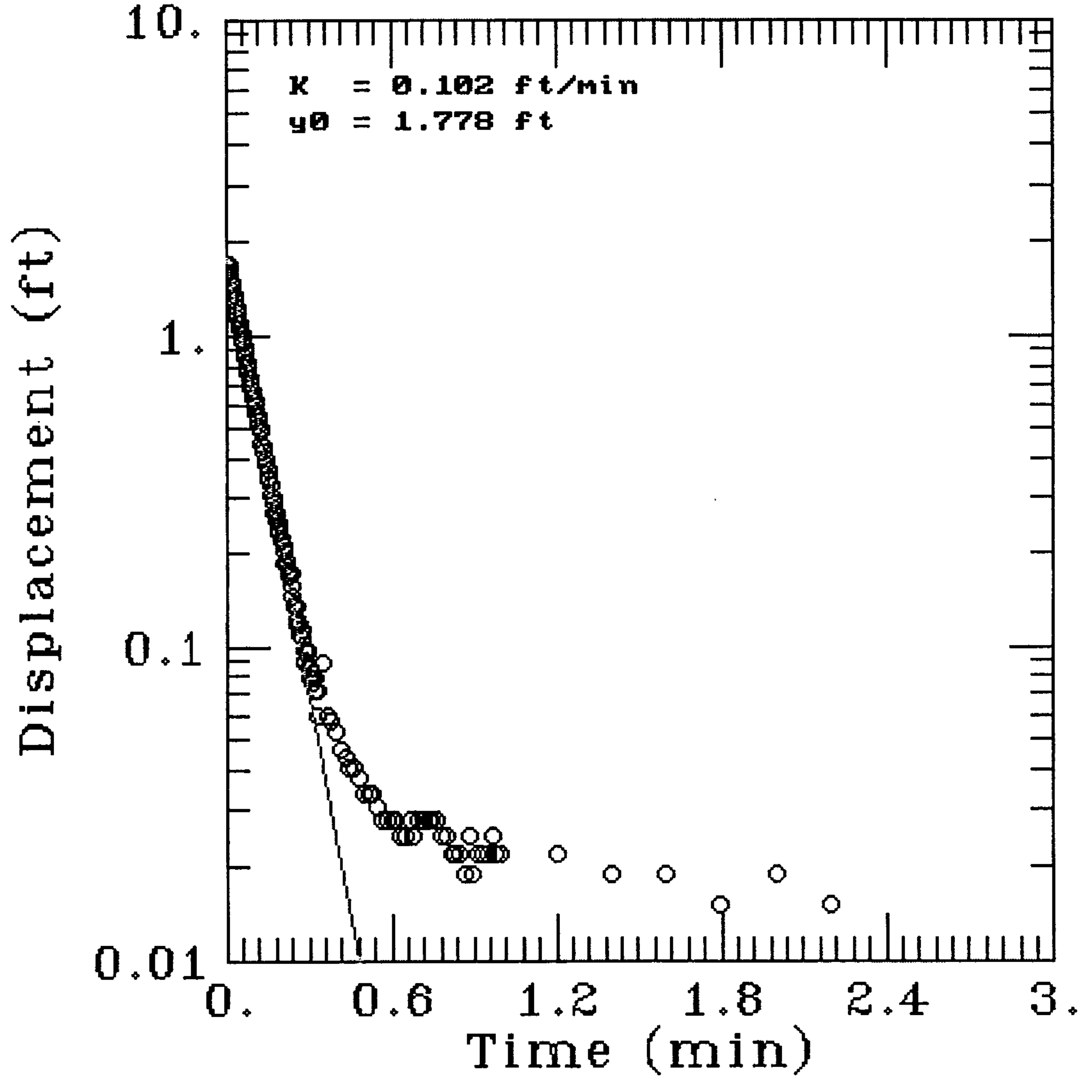
GERAGHTY & MILLER, INC.

Modeling Group



57M-95-04B Rising Head
K = 0.02337 ft/min
y0 = 2.055 ft
Displacement (ft)
10.
1.
0.1
0.01
0.001
0.
0.4
0.8
1.2
1.6
2.
Time (min)
AQTESOLV
GERAGHTY
& MILLER, INC.
Modeling Group

57M-95-05X Rising Head



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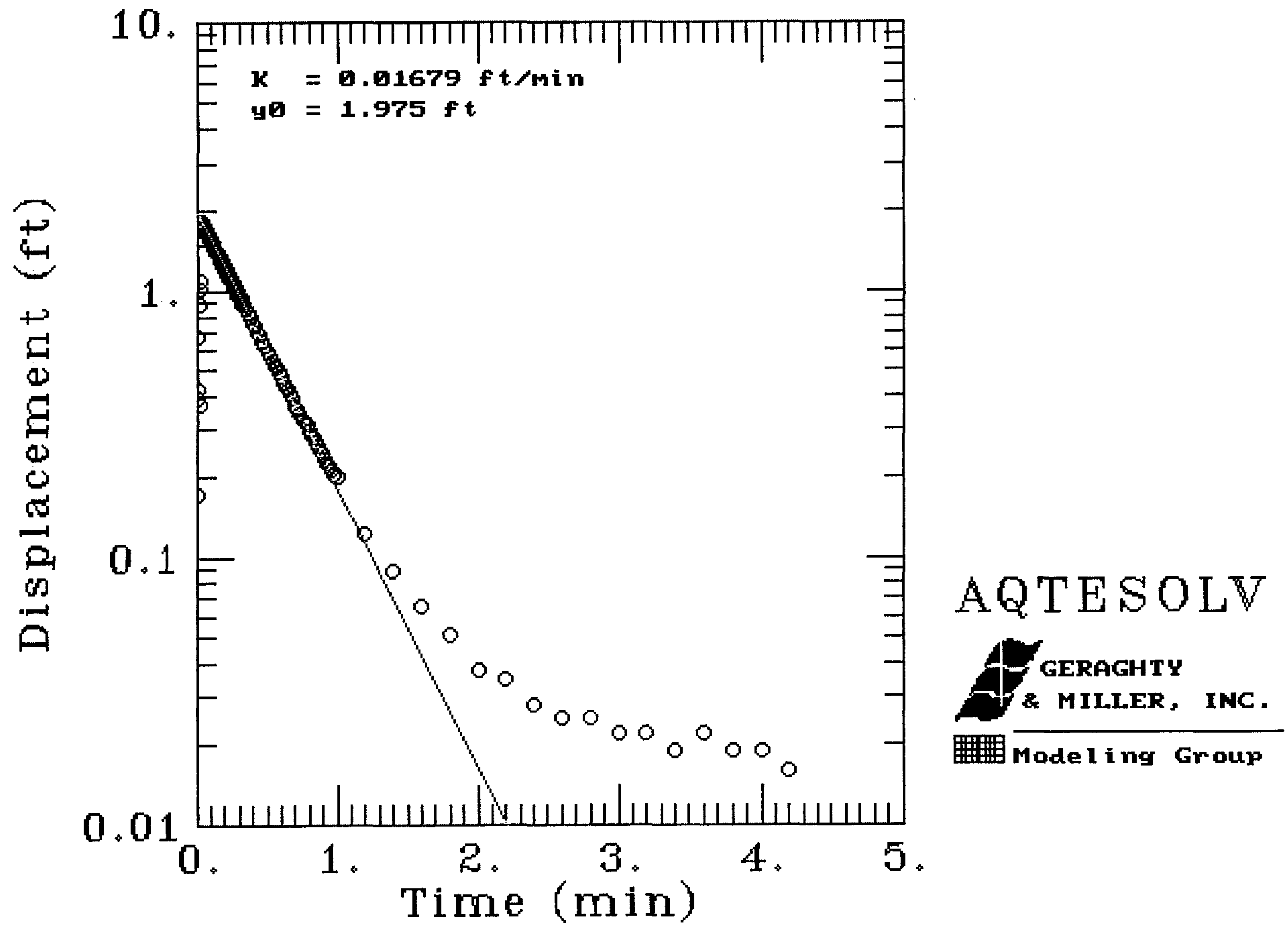
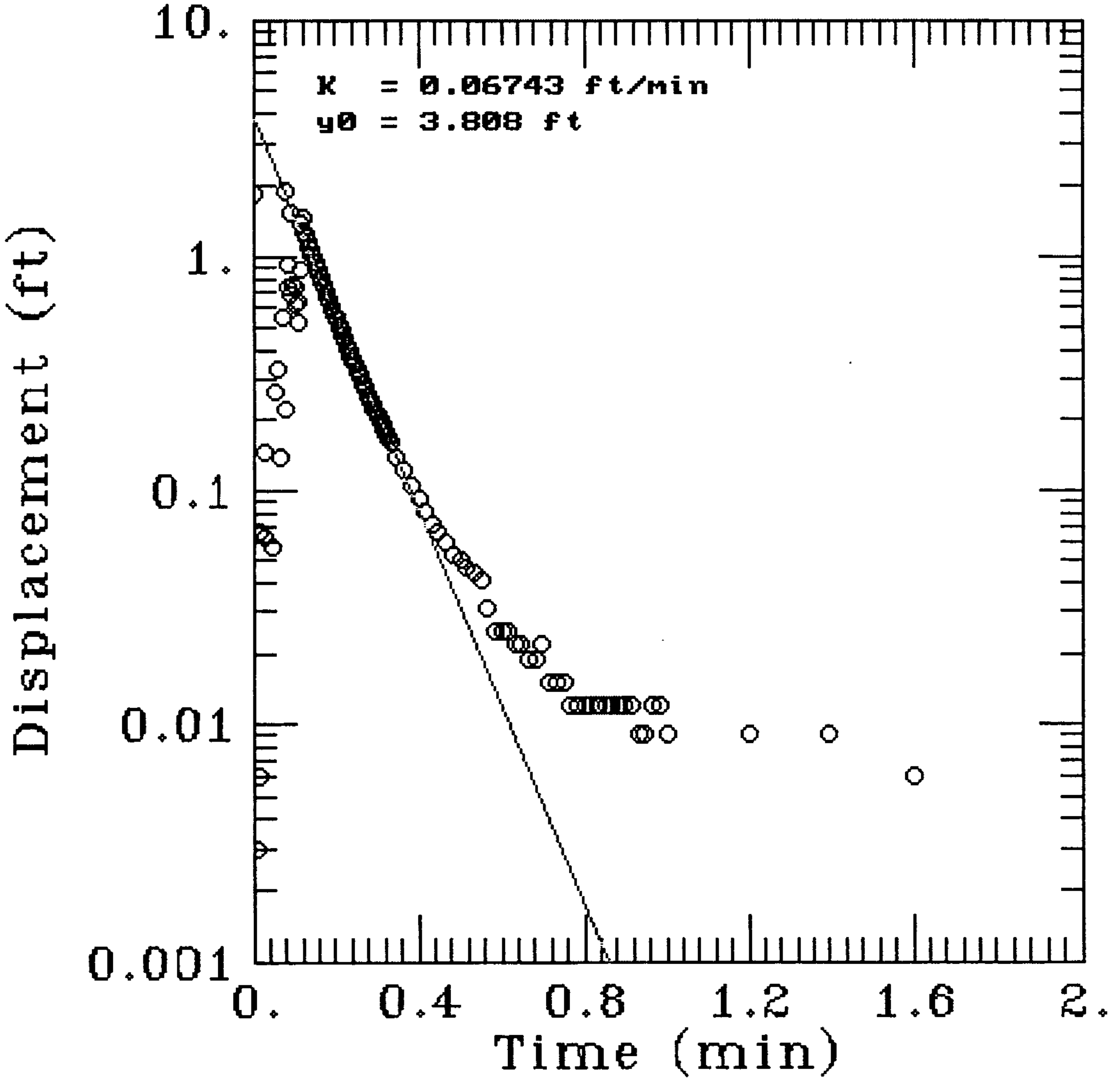
57M-95-06X Rising Head



57M-95-07X Rising Head



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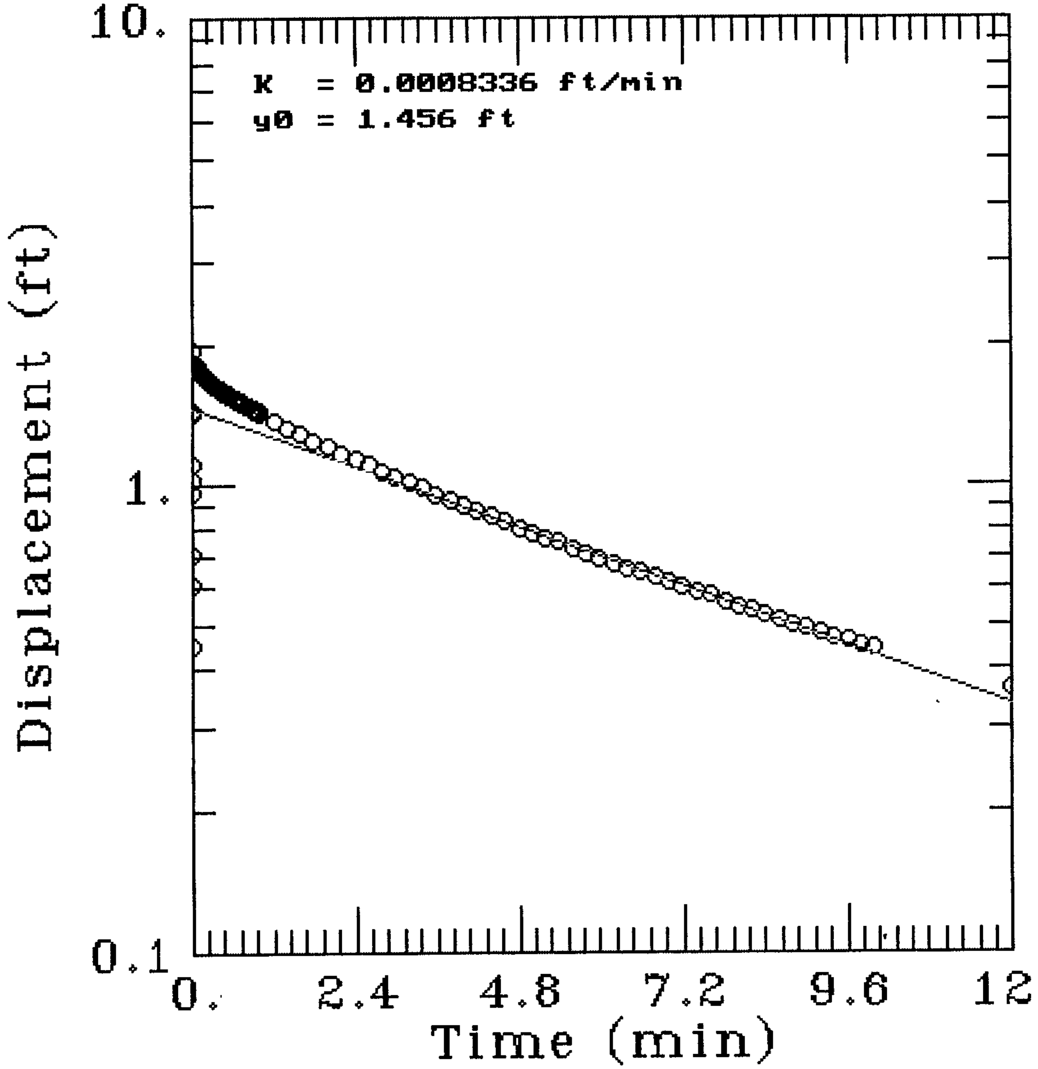
Modeling Group

57M-95-08A Rising Head



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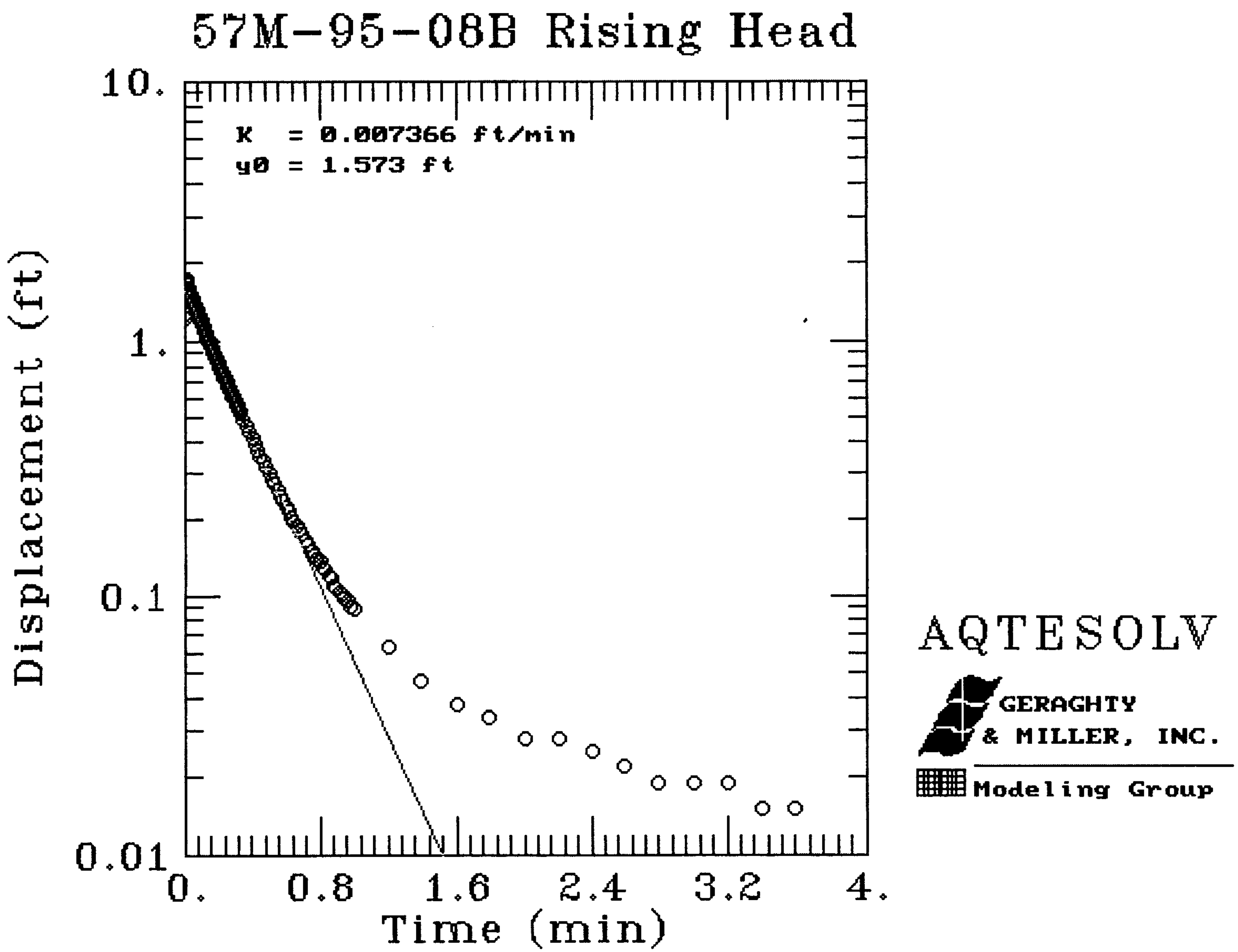
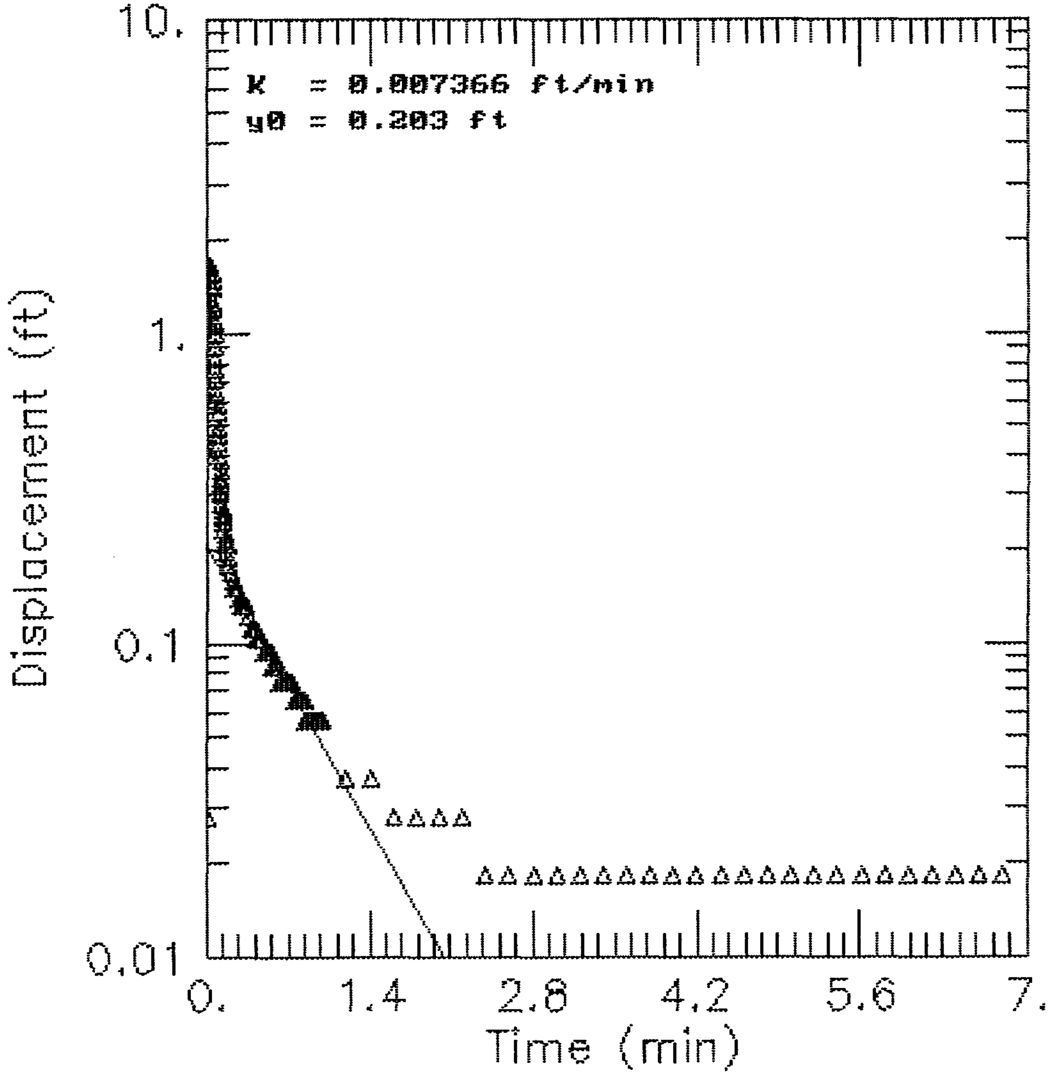
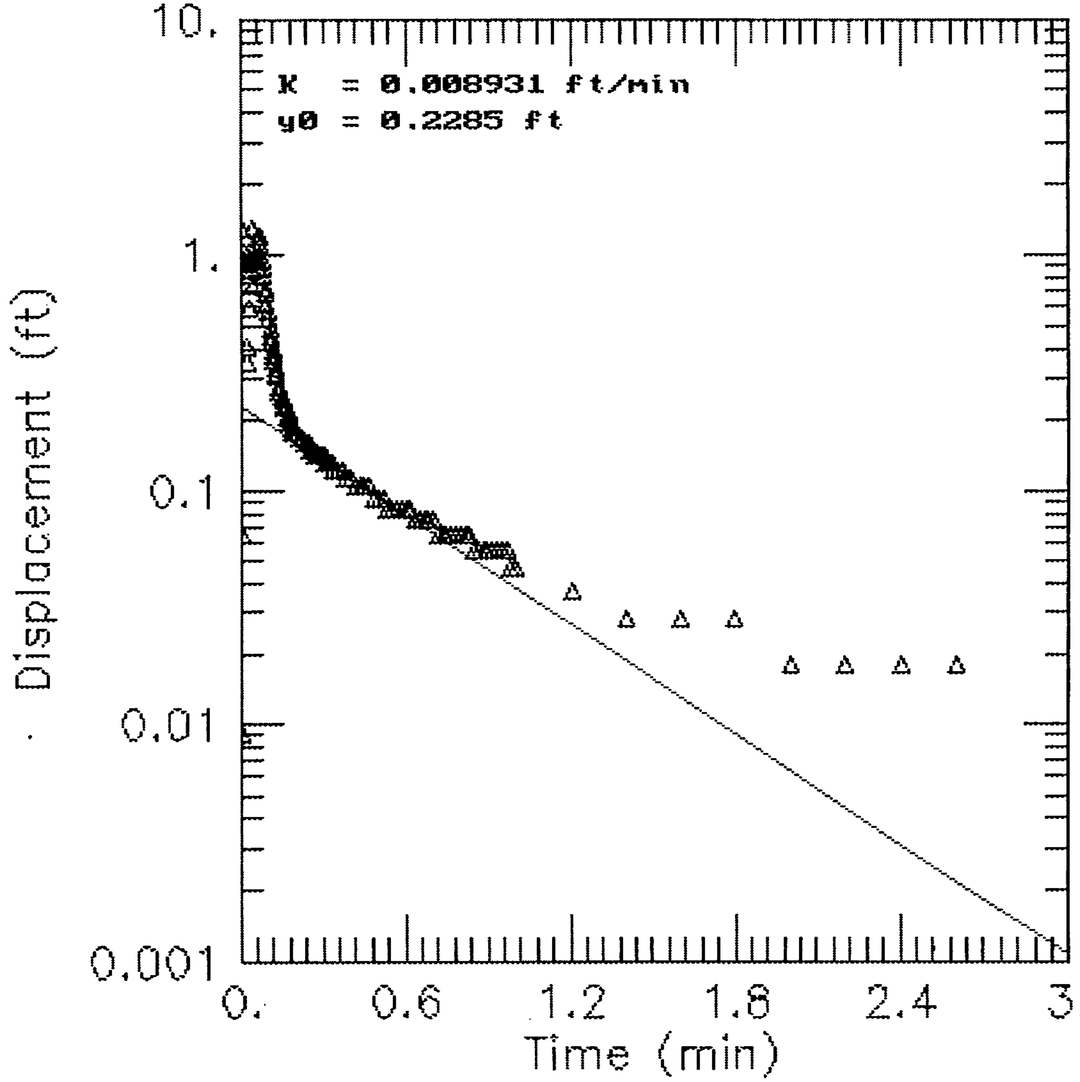

57M-95-08B Rising Head
K = 0.007366 ft/min
y0 = 1.573 ft
Displacement (ft)
10.
1.
0.1
0.01
0.
0.8
1.6
2.4
3.2
4.
Time (min)
AQTESOLV
GERAGHTY
& MILLER, INC.
Modeling Group

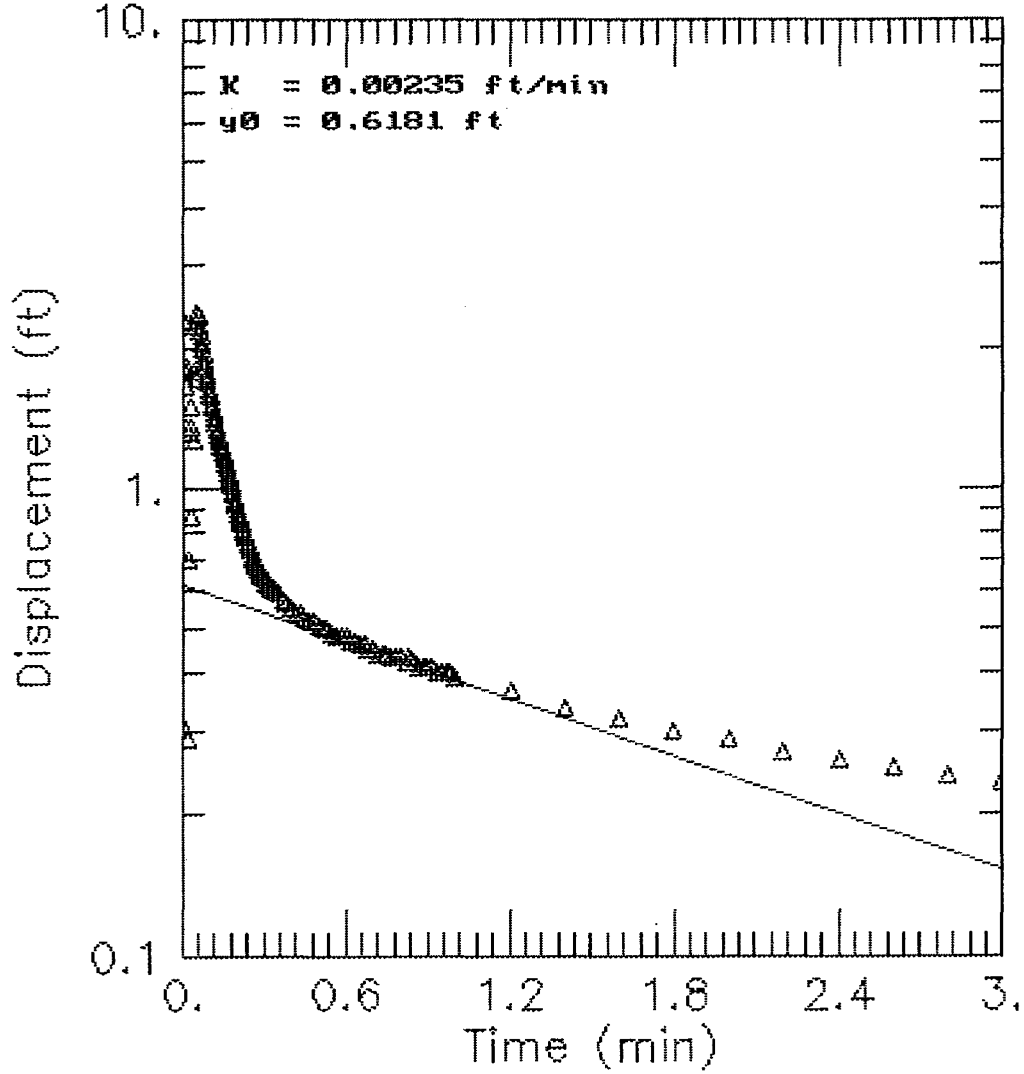
57M-96-09X RISING HEAD TEST #1



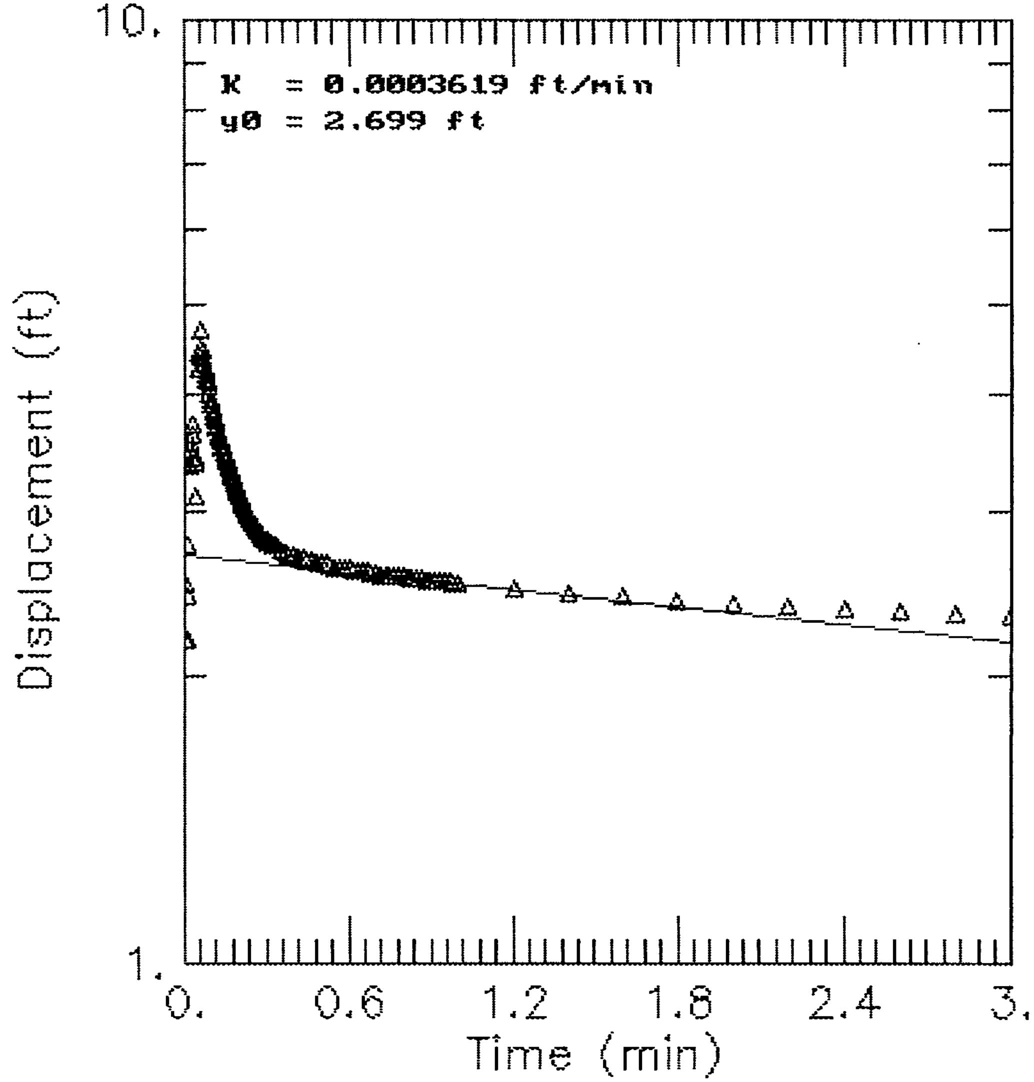
57M-96-09X RISING HEAD TEST #2



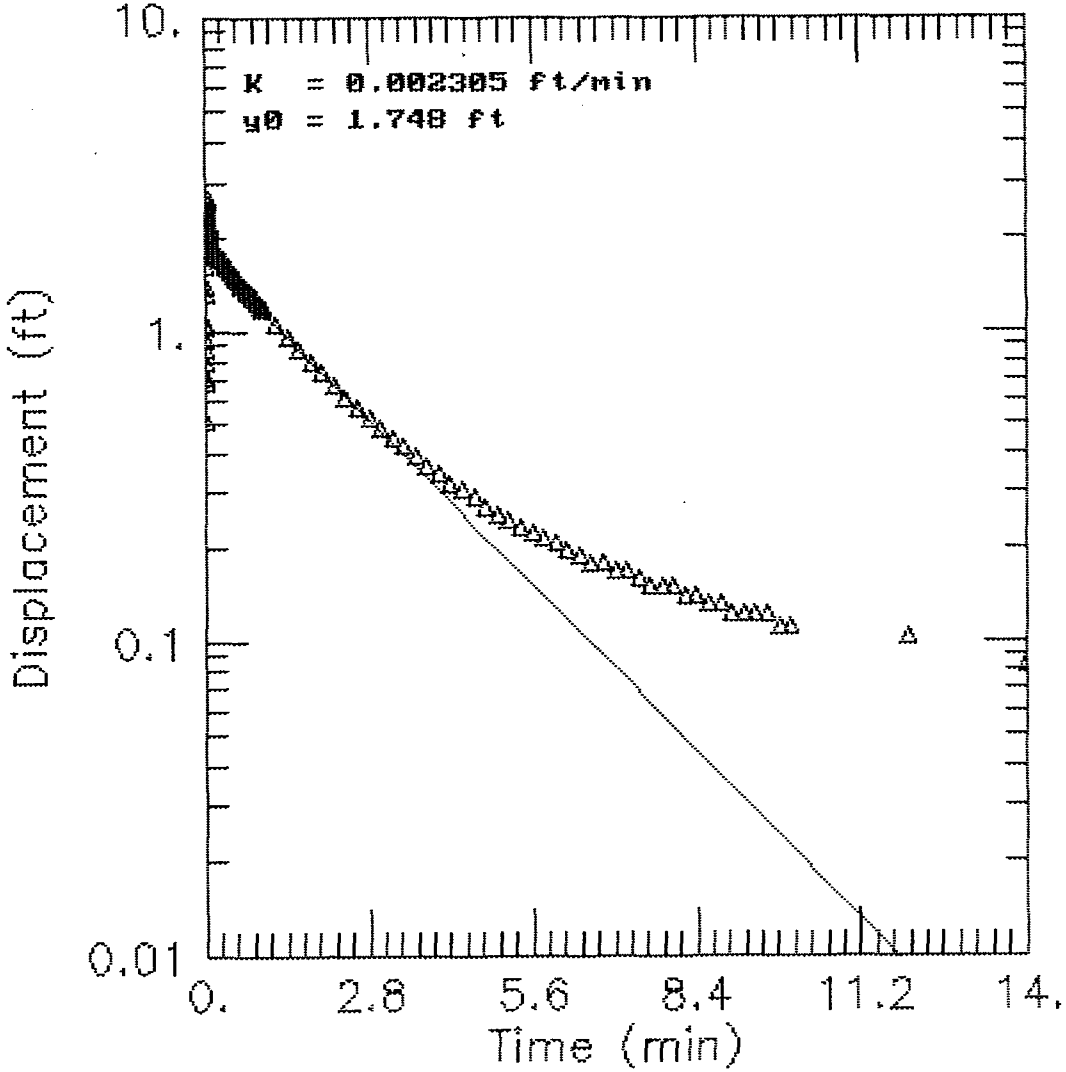
57M−96−10X RISING HEAD TEST #1

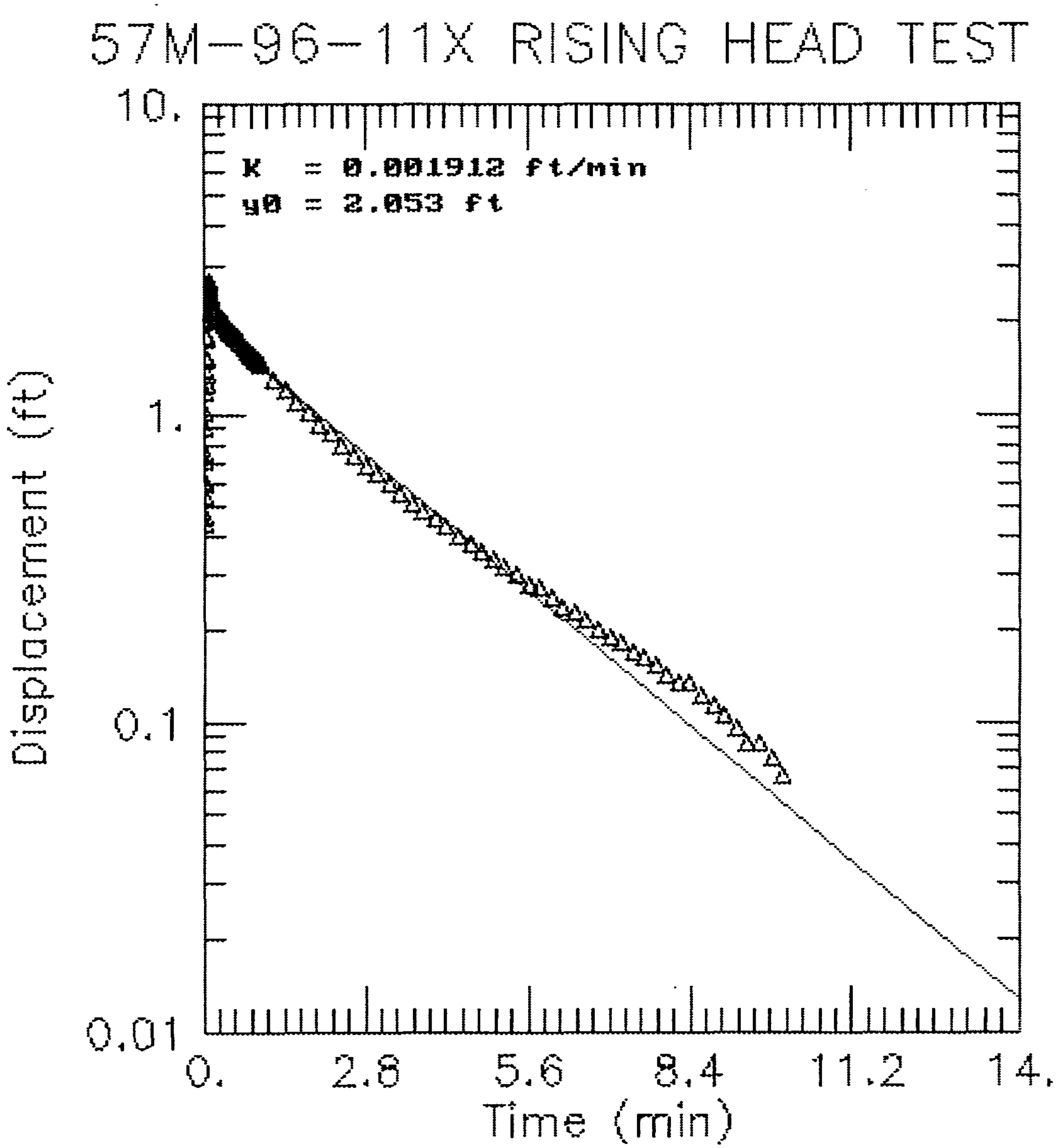


57M-96-10X RISNG HEAD TEST #2

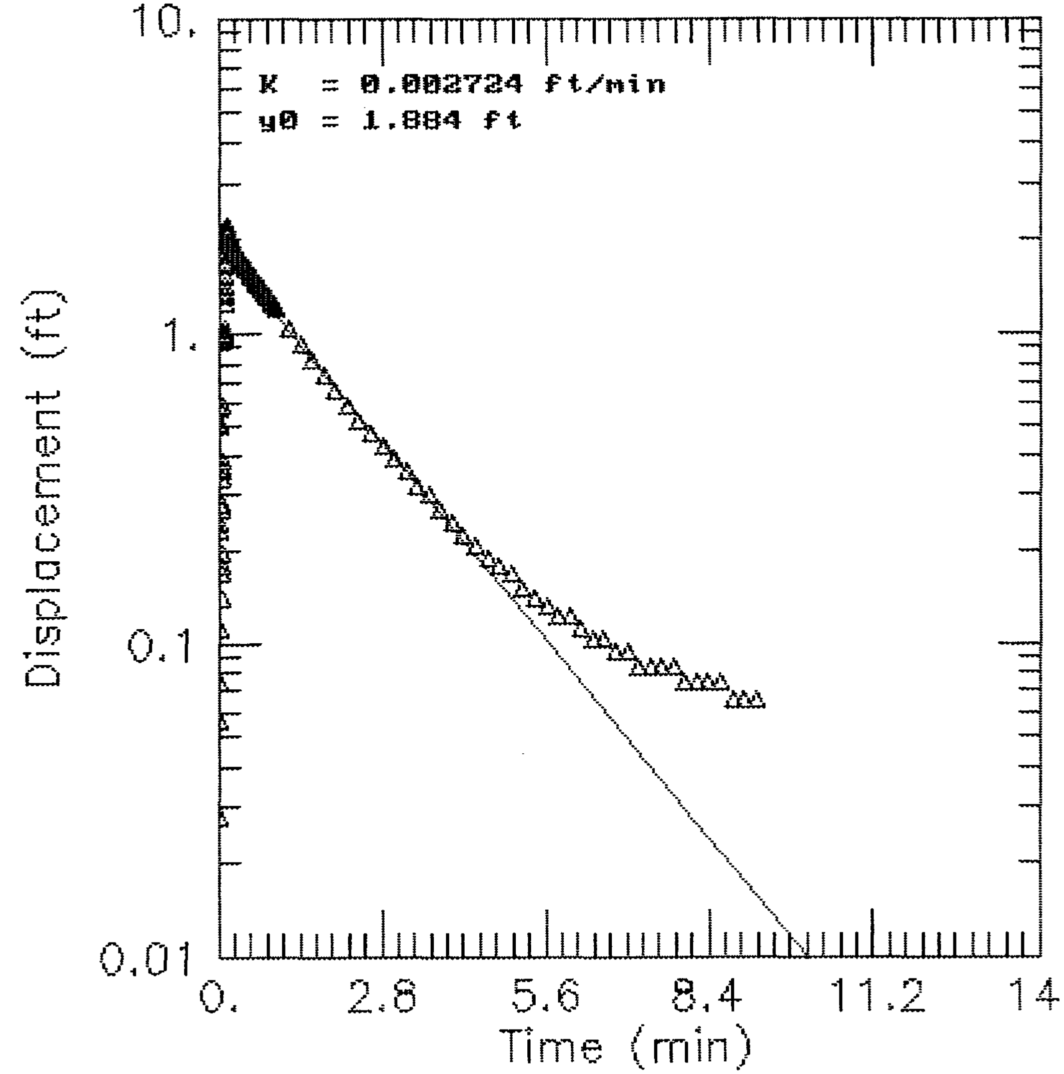


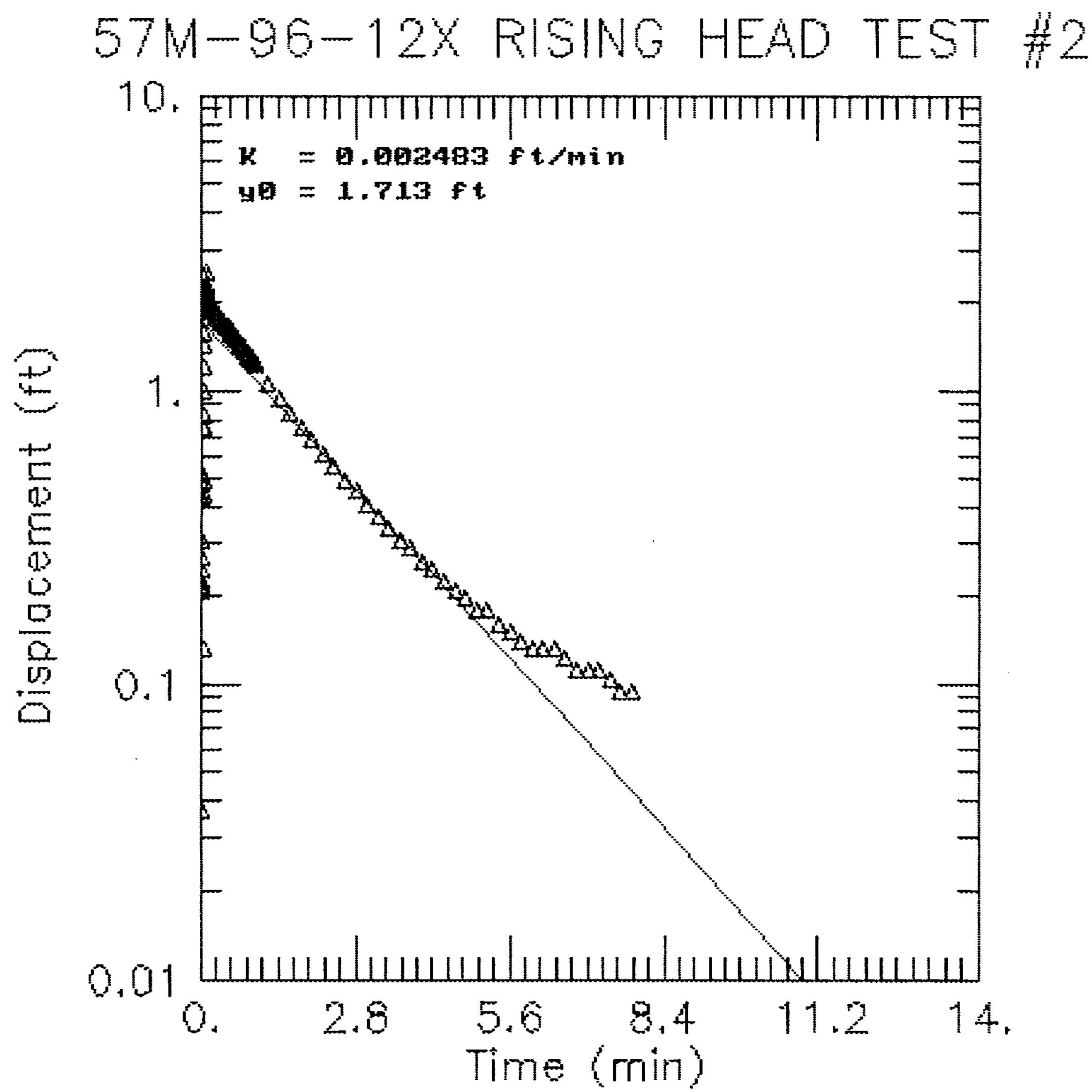
57M-96-11X RISING HEAD TEST #1



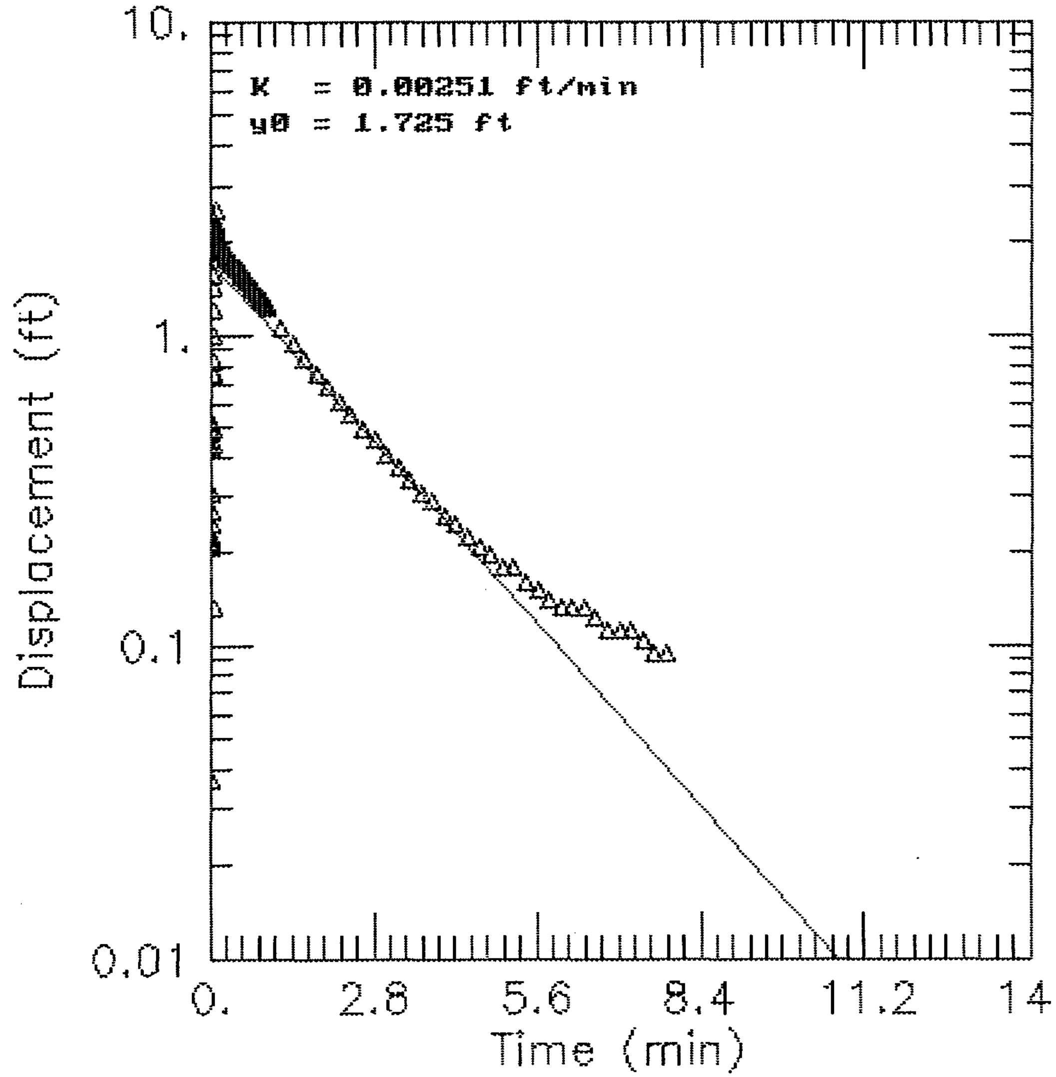

57M–96–11X RISING HEAD TEST #2
K = 0.001912 ft/min
y0 = 2.053 ft
Displacement (ft)
10.
1.
0.1
0.01
0.
2.8
5.6
8.4
11.2
14.
Time (min)

57M-96-12X RISING HEAD TEST #1

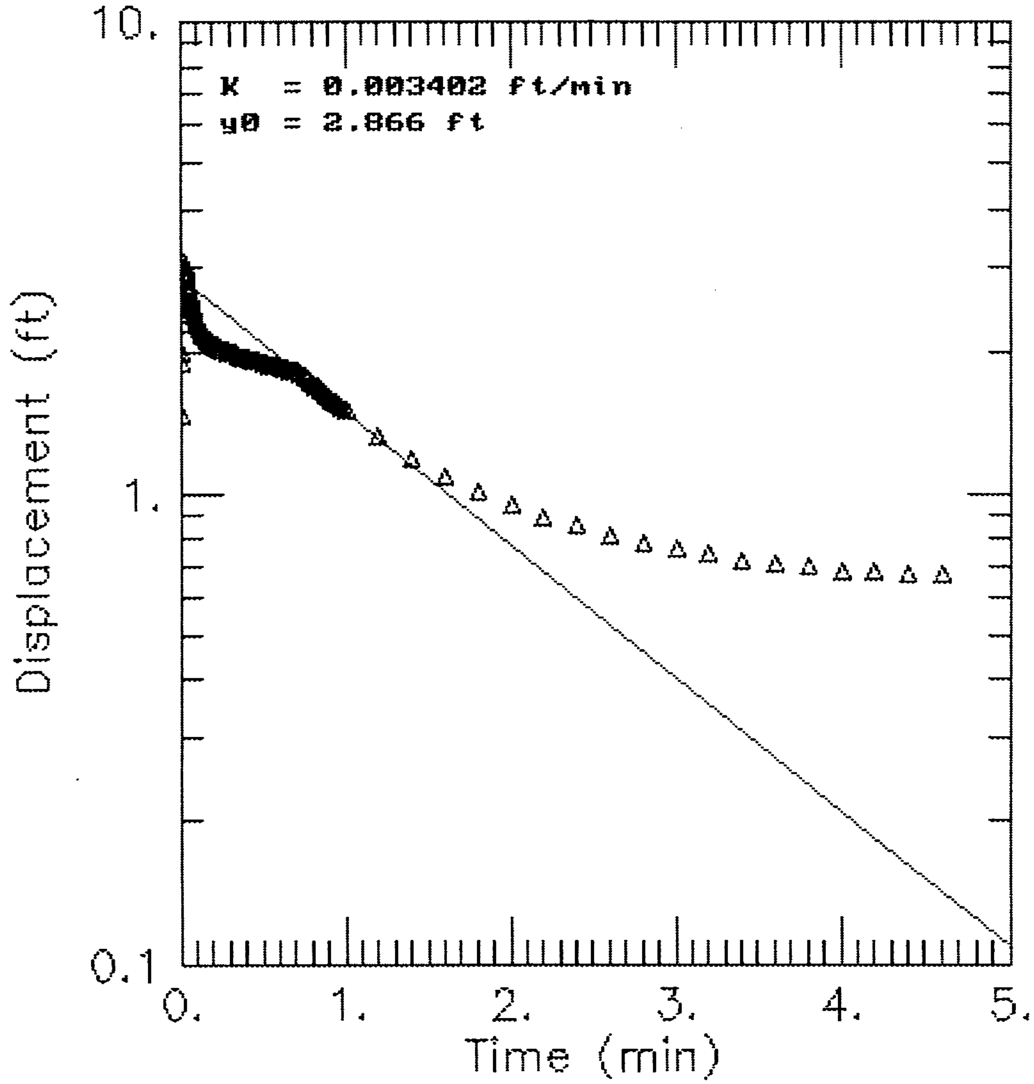



57M-96-12X RISING HEAD TEST #2
K = 0.002483 ft/min
y0 = 1.713 ft
Displacement (ft)
10.
1.
0.1
0.01
Time (min)
0.
2.8
5.6
8.4
11.2
14.

57M-96-13X RISING HEAD TEST #1



57M-96-13X RISING HEAD TEST #2



CALCULATION OF HYDRAULIC CONDUCTIVITIES USING THE HVORSLEV EQUATION
AOC 57

K = -[(LOG Ht1 - LOG Ht2)/(t1 - t2)]{[(r)^2 LOG (L/R)]/2L}

WHERE:
- t1 = TIME 1 (MINUTES)
- t2 = TIME 2 (MINUTES)
- Ht1 = HEAD STRESS AT TIME 1 (FEET)
- Ht2 = HEAD STRESS AT TIME 2 (FEET)
- r = RADIUS OF WELL CASING (FEET)
- R = RADUS OF BOREHOLE (FEET)
- L = EFFECTIVE SATURATED LENGTH OF SCREEN (FEET)

											AVERAGE OF MULTIPLE TESTS	
WELL	t1	t2	Ht1	Ht2	r	R	L	TYPE	K (FT/MIN)	K (CM/SEC)	K (FT/MIN)	K (CM/SEC)
57M-95-01X	0.035	0.1	0.654	0.132	0.17	0.46	7.09	RISING	2.5E-02	1.3E-02		
57M-95-02X	0.05	0.2	1.207	0.063	0.17	0.46	9.81	RISING	1.6E-02	8.2E-03		
57M-95-03X	0.1	0.3	1.788	1.37	0.17	0.46	10.51	RISING	1.0E-03	5.3E-04		
57M-95-04A	0.08	0.3	1.05	0.205	0.17	0.46	10.75	RISING	5.7E-03	2.9E-03		
57M-95-04B	0.1	0.3	0.725	0.091	0.17	0.46	17	RISING	5.8E-03	2.9E-03		
57M-95-05X	0.1	0.3	0.63	0.085	0.17	0.46	7.09	RISING	1.0E-02	5.1E-03		
57M-95-06X	0.1	0.6	1.544	0.472	0.17	0.46	12.32	RISING	1.7E-03	8.4E-04		
57M-95-07X	0.15	0.3	0.956	0.212	0.17	0.46	12.37	RISING	7.0E-03	3.6E-03		
57M-95-08A	4.6	7.2	0.832	0.601	0.17	0.46	13	RISING	8.4E-05	4.3E-05		
57M-95-08B	0.1	0.4	1.193	0.418	0.17	0.46	17	RISING	2.0E-03	1.0E-03		
57M-96-09X[1]	0.4	0.8	0.112	0.065	0.08	0.33	8.7	RISING	3.3E-04	1.7E-04		
57M-96-09X[2]	0.3	0.5	0.14	0.093	0.08	0.33	8.7	RISING	5.0E-04	2.6E-04	4.2E-04	2.1E-04
57M-96-10X[1]	1.2	2	0.366	0.29	0.08	0.33	9.0	RISING	7.0E-05	3.5E-05		
57M-96-10X[2]	0.8	1.4	2.562	2.449	0.08	0.33	9.0	RISING	1.8E-05	9.2E-06	4.4E-05	2.2E-05
57M-96-11X[1]	1.6	2.8	0.872	0.525	0.08	0.33	10.9	RISING	8.9E-05	4.5E-05		
57M-96-11X[2]	2.8	4	0.366	0.14	0.08	0.33	10.9	RISING	1.7E-04	8.5E-05	1.3E-04	6.5E-05
57M-96-12X[1]	1	3	1.192	0.394	0.08	0.33	10.7	RISING	1.2E-04	6.0E-05		
57M-96-12X[2]	0.8	2.4	1.379	0.553	0.08	0.33	10.7	RISING	1.2E-04	6.2E-05	1.2E-04	6.1E-05
57M-96-13X[1]	0.6	1	1.248	0.863	0.08	0.33	10.4	RISING	2.0E-04	1.0E-04		
57M-96-13X[2]	0.8	1.6	1.717	1.088	0.08	0.33	10.4	RISING	1.2E-04	6.3E-05	1.6E-04	8.2E-05

NOTES:
1) Rising Head Test #1
2) Rising Head Test #2

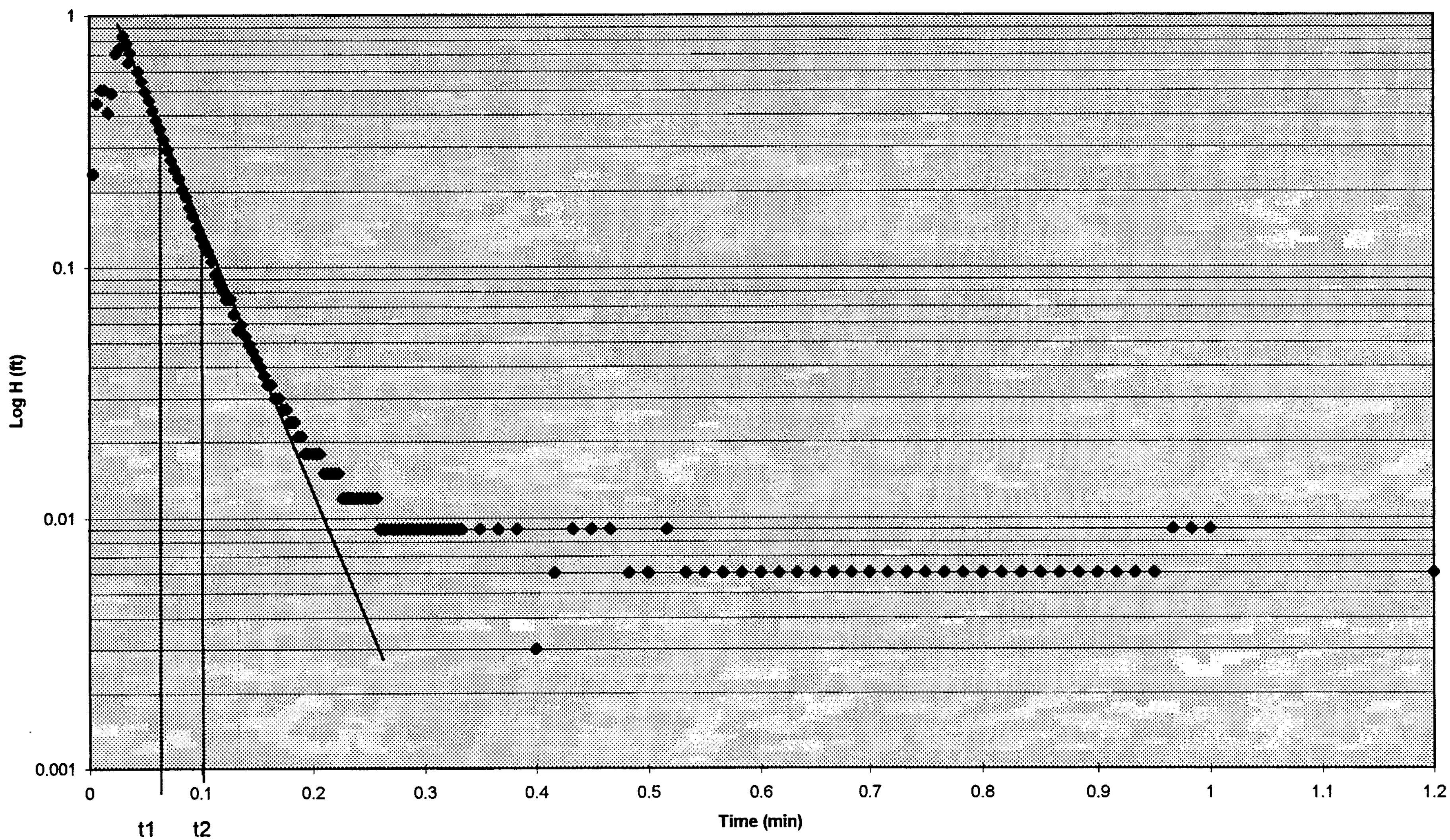
Well ID: 57M-95-01X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 19-29 ft.
Water Column Height: 7.09 ft.

Time (min)	delta H (ft.)
0	0.515
0.0033	0.236
0.0066	0.445
0.01	0.505
0.0133	0.505
0.0166	0.41
0.02	0.489
0.0233	0.711
0.0266	0.746
0.03	0.832
0.0333	0.778
0.0366	0.714
0.035	0.654
0.0433	0.6
0.0466	0.55
0.05	0.499
0.0533	0.458
0.0566	0.417
0.06	0.382
0.0633	0.353
0.0666	0.322
0.07	0.293
0.0733	0.268
0.0766	0.246
0.08	0.227
0.0833	0.205
0.0866	0.192
0.09	0.173
0.0933	0.16
0.0966	0.144
0.1	0.132
0.1033	0.122
0.1066	0.116
0.11	0.106
0.1133	0.094
0.1166	0.087
0.12	0.081
0.1233	0.075
0.1266	0.075
0.13	0.065
0.1333	0.056
0.1366	0.059
0.14	0.053
0.1433	0.049
0.1466	0.046
0.15	0.043
0.1533	0.04
0.1566	0.037
0.16	0.034
0.1633	0.034

Time (min)	delta H (ft.)					
0.1666	0.03					
0.17	0.03					
0.1733	0.027					
0.1766	0.027					
0.18	0.024					
0.1833	0.024					
0.1866	0.021					
0.19	0.021					
0.1933	0.018					
0.1966	0.018					
0.2	0.018					
0.2033	0.018					
0.2066	0.018					
0.21	0.015					
0.2133	0.015					
0.2166	0.015					
0.22	0.015					
0.2233	0.015					
0.2266	0.012					
0.23	0.012					
0.2333	0.012					
0.2366	0.012					
0.24	0.012					
0.2433	0.012					
0.2466	0.012					
0.25	0.012					
0.2533	0.012					
0.2566	0.012					
0.26	0.009					
0.2633	0.009					
0.2666	0.009					
0.27	0.009					
0.2733	0.009					
0.2766	0.009					
0.28	0.009					
0.2833	0.009					
0.2866	0.009					
0.29	0.009					
0.2933	0.009					
0.2966	0.009					
0.3	0.009					
0.3033	0.009					
0.3066	0.009					
0.31	0.009					
0.3133	0.009					
0.3166	0.009					
0.32	0.009					
0.3233	0.009					
0.3266	0.009					
0.33	0.009					

Time (min)	delta H (ft.)				
0.3333	0.009				
0.35	0.009				
0.3666	0.009				
0.3833	0.009				
0.4	0.003				
0.4166	0.006				
0.4333	0.009				
0.45	0.009				
0.4666	0.009				
0.4833	0.006				
0.5	0.006				
0.5166	0.009				
0.5333	0.006				
0.55	0.006				
0.5666	0.006				
0.5833	0.006				
0.6	0.006				
0.6166	0.006				
0.6333	0.006				
0.65	0.006				
0.6666	0.006				
0.6833	0.006				
0.7	0.006				
0.7166	0.006				
0.7333	0.006				
0.75	0.006				
0.7666	0.006				
0.7833	0.006				
0.8	0.006				
0.8166	0.006				
0.8333	0.006				
0.85	0.006				
0.8666	0.006				
0.8833	0.006				
0.9	0.006				
0.9166	0.006				
0.9333	0.006				
0.95	0.006				
0.9666	0.009				
0.9833	0.009				
1	0.009				
1.2	0.006				

57M-95-01X RISING HEAD



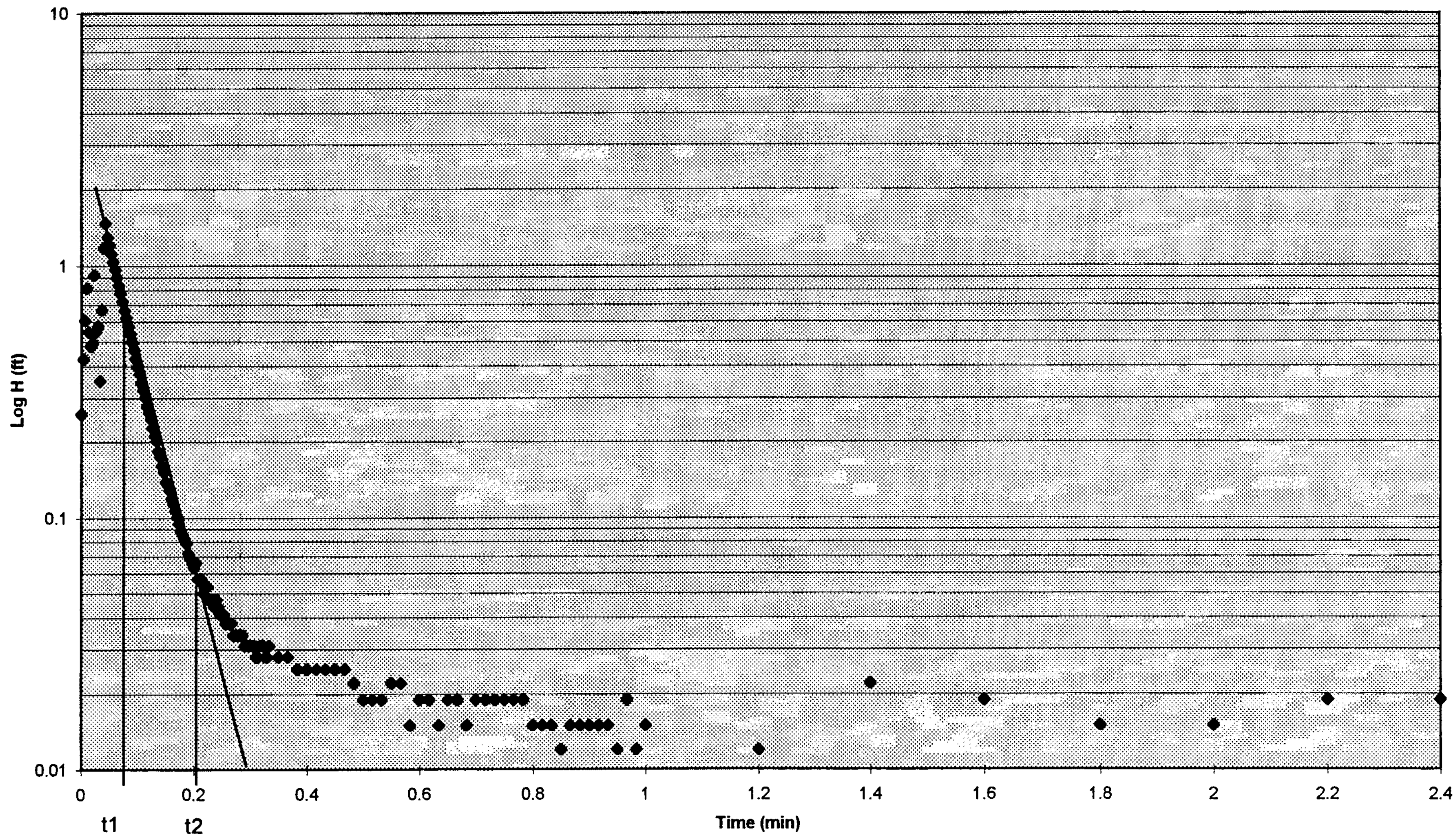
Well ID: 57M-95-02X
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 14-24 ft.
Water Column Height: 8.81 ft.

Time (min)	delta H (ft.)
0	0.259
0.0033	0.427
0.0066	0.608
0.01	0.814
0.0133	0.545
0.0166	0.478
0.02	0.494
0.0233	0.922
0.0266	0.548
0.03	0.573
0.0333	0.351
0.0366	0.668
0.04	1.182
0.0433	1.473
0.0466	1.302
0.05	1.207
0.0533	1.118
0.0566	1.039
0.06	0.969
0.0633	0.9
0.0666	0.833
0.07	0.779
0.0733	0.722
0.0766	0.665
0.08	0.621
0.0833	0.576
0.0866	0.535
0.09	0.497
0.0933	0.462
0.0966	0.427
0.1	0.399
0.1033	0.373
0.1066	0.345
0.11	0.323
0.1133	0.301
0.1166	0.278
0.12	0.263
0.1233	0.247
0.1266	0.228
0.13	0.212
0.1333	0.202
0.1366	0.183
0.14	0.174
0.1433	0.161
0.1466	0.152
0.15	0.139
0.1533	0.136
0.1566	0.129
0.16	0.12
0.1633	0.114

Time (min)	delta H (ft.)					
0.1666	0.107					
0.17	0.101					
0.1733	0.095					
0.1766	0.088					
0.18	0.085					
0.1833	0.082					
0.1866	0.079					
0.19	0.072					
0.1933	0.069					
0.1966	0.066					
0.2	0.063					
0.2033	0.066					
0.2066	0.057					
0.21	0.057					
0.2133	0.057					
0.2166	0.05					
0.22	0.053					
0.2233	0.053					
0.2266	0.047					
0.23	0.047					
0.2333	0.047					
0.2366	0.044					
0.24	0.047					
0.2433	0.044					
0.2466	0.041					
0.25	0.041					
0.2533	0.041					
0.2566	0.038					
0.26	0.038					
0.2633	0.038					
0.2666	0.038					
0.27	0.034					
0.2733	0.034					
0.2766	0.034					
0.28	0.034					
0.2833	0.034					
0.2866	0.034					
0.29	0.031					
0.2933	0.031					
0.2966	0.031					
0.3	0.031					
0.3033	0.031					
0.3066	0.031					
0.31	0.028					
0.3133	0.028					
0.3166	0.031					
0.32	0.031					
0.3233	0.031					
0.3266	0.028					
0.33	0.028					

Time (min)	delta H (ft.)					
0.3333	0.031					
0.35	0.028					
0.3666	0.028					
0.3833	0.025					
0.4	0.025					
0.4166	0.025					
0.4333	0.025					
0.45	0.025					
0.4666	0.025					
0.4833	0.022					
0.5	0.019					
0.5166	0.019					
0.5333	0.019					
0.55	0.022					
0.5666	0.022					
0.5833	0.015					
0.6	0.019					
0.6166	0.019					
0.6333	0.015					
0.65	0.019					
0.6666	0.019					
0.6833	0.015					
0.7	0.019					
0.7166	0.019					
0.7333	0.019					
0.75	0.019					
0.7666	0.019					
0.7833	0.019					
0.8	0.015					
0.8166	0.015					
0.8333	0.015					
0.85	0.012					
0.8666	0.015					
0.8833	0.015					
0.9	0.015					
0.9166	0.015					
0.9333	0.015					
0.95	0.012					
0.9666	0.019					
0.9833	0.012					
1	0.015					
1.2	0.012					
1.4	0.022					
1.6	0.019					
1.8	0.015					
2	0.015					
2.2	0.019					
2.4	0.019					

57M-95-02X RISING HEAD



Well ID: 57M-95-03X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 7-17 ft.
Water Column Height: 9.51 ft.

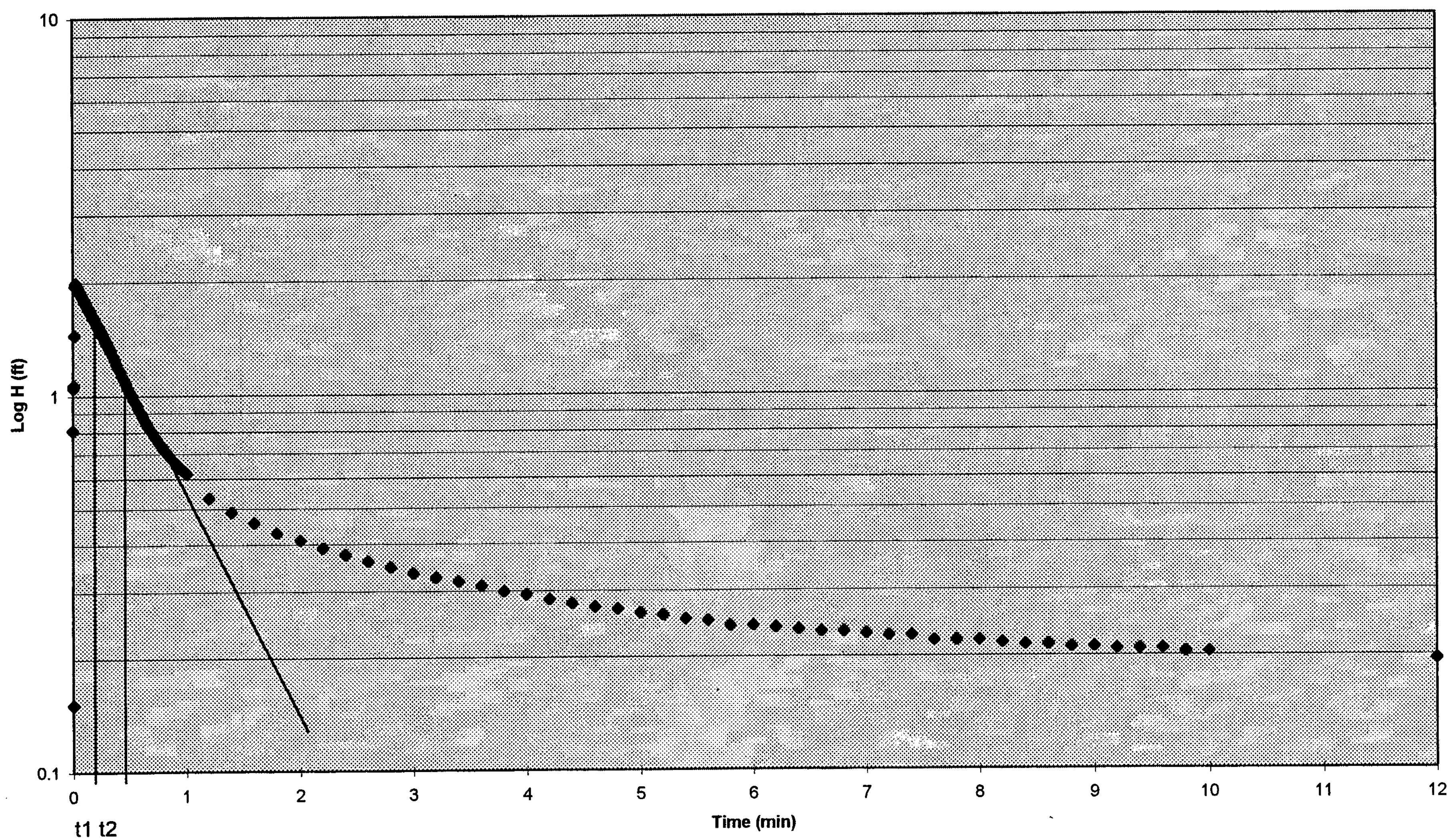
Time (min)	delta H (ft.)
0	0.809
0.0033	1.05
0.0066	0.151
0.01	1.066
0.0133	1.443
0.0166	1.959
0.0233	1.99
0.0266	1.987
0.03	1.971
0.0333	1.959
0.0366	1.949
0.04	1.94
0.0433	1.937
0.0466	1.921
0.05	1.924
0.0533	1.902
0.0566	1.892
0.06	1.899
0.0633	1.876
0.0666	1.87
0.07	1.864
0.0733	1.857
0.0766	1.848
0.08	1.838
0.0833	1.829
0.0866	1.823
0.09	1.813
0.0933	1.807
0.0966	1.797
0.1	1.788
0.1033	1.769
0.1066	1.778
0.11	1.762
0.1133	1.762
0.1166	1.75
0.12	1.743
0.1233	1.734
0.1266	1.728
0.13	1.721
0.1333	1.705
0.1366	1.709
0.14	1.686
0.1433	1.693
0.1466	1.693
0.15	1.677
0.1533	1.674
0.1566	1.661
0.16	1.652
0.1633	1.645
0.1666	1.636

Time (min)	delta H (ft.)					
0.17	1.629					
0.1733	1.62					
0.1766	1.598					
0.18	1.607					
0.1833	1.604					
0.1866	1.601					
0.19	1.588					
0.1933	1.582					
0.1966	1.576					
0.2	1.566					
0.2033	1.553					
0.2066	1.553					
0.21	1.55					
0.2133	1.528					
0.2166	1.534					
0.22	1.525					
0.2233	1.506					
0.2266	1.515					
0.23	1.506					
0.2333	1.503					
0.2366	1.493					
0.24	1.481					
0.2433	1.49					
0.2466	1.471					
0.25	1.465					
0.2533	1.471					
0.2566	1.449					
0.26	1.443					
0.2633	1.439					
0.2666	1.433					
0.27	1.427					
0.2733	1.424					
0.2766	1.417					
0.28	1.408					
0.2833	1.401					
0.2866	1.389					
0.29	1.389					
0.2933	1.382					
0.2966	1.373					
0.3	1.37					
0.3033	1.36					
0.3066	1.357					
0.31	1.354					
0.3133	1.344					
0.3166	1.341					
0.32	1.335					
0.3233	1.325					
0.3266	1.322					
0.33	1.316					
0.3333	1.31					

Time (min)	delta H (ft.)					
0.35	1.278					
0.3666	1.246					
0.3833	1.211					
0.4	1.183					
0.4166	1.161					
0.4333	1.129					
0.45	1.104					
0.4666	1.075					
0.4833	1.047					
0.5	1.025					
0.5166	1.002					
0.5333	0.977					
0.55	0.958					
0.5666	0.939					
0.5833	0.914					
0.6	0.898					
0.6166	0.879					
0.6333	0.86					
0.65	0.841					
0.6666	0.822					
0.6833	0.809					
0.7	0.797					
0.7166	0.781					
0.7333	0.768					
0.75	0.755					
0.7666	0.743					
0.7833	0.73					
0.8	0.717					
0.8166	0.711					
0.8333	0.698					
0.85	0.689					
0.8666	0.679					
0.8833	0.67					
0.9	0.664					
0.9166	0.654					
0.9333	0.648					
0.95	0.638					
0.9666	0.632					
0.9833	0.626					
1	0.619					
1.2	0.534					
1.4	0.489					
1.6	0.458					
1.8	0.429					
2	0.41					
2.2	0.391					
2.4	0.375					
2.6	0.36					
2.8	0.347					
3	0.334					

Time (min)	delta H (ft.)					
3.2	0.325					
3.4	0.318					
3.6	0.309					
3.8	0.299					
4	0.293					
4.2	0.284					
4.4	0.277					
4.6	0.271					
4.8	0.268					
5	0.261					
5.2	0.258					
5.4	0.252					
5.6	0.249					
5.8	0.242					
6	0.242					
6.2	0.239					
6.4	0.236					
6.6	0.233					
6.8	0.233					
7	0.23					
7.2	0.227					
7.4	0.227					
7.6	0.22					
7.8	0.22					
8	0.22					
8.2	0.217					
8.4	0.214					
8.6	0.214					
8.8	0.211					
9	0.211					
9.2	0.208					
9.4	0.208					
9.6	0.208					
9.8	0.204					
10	0.204					
12	0.195					

57M-95-03X RISING HEAD



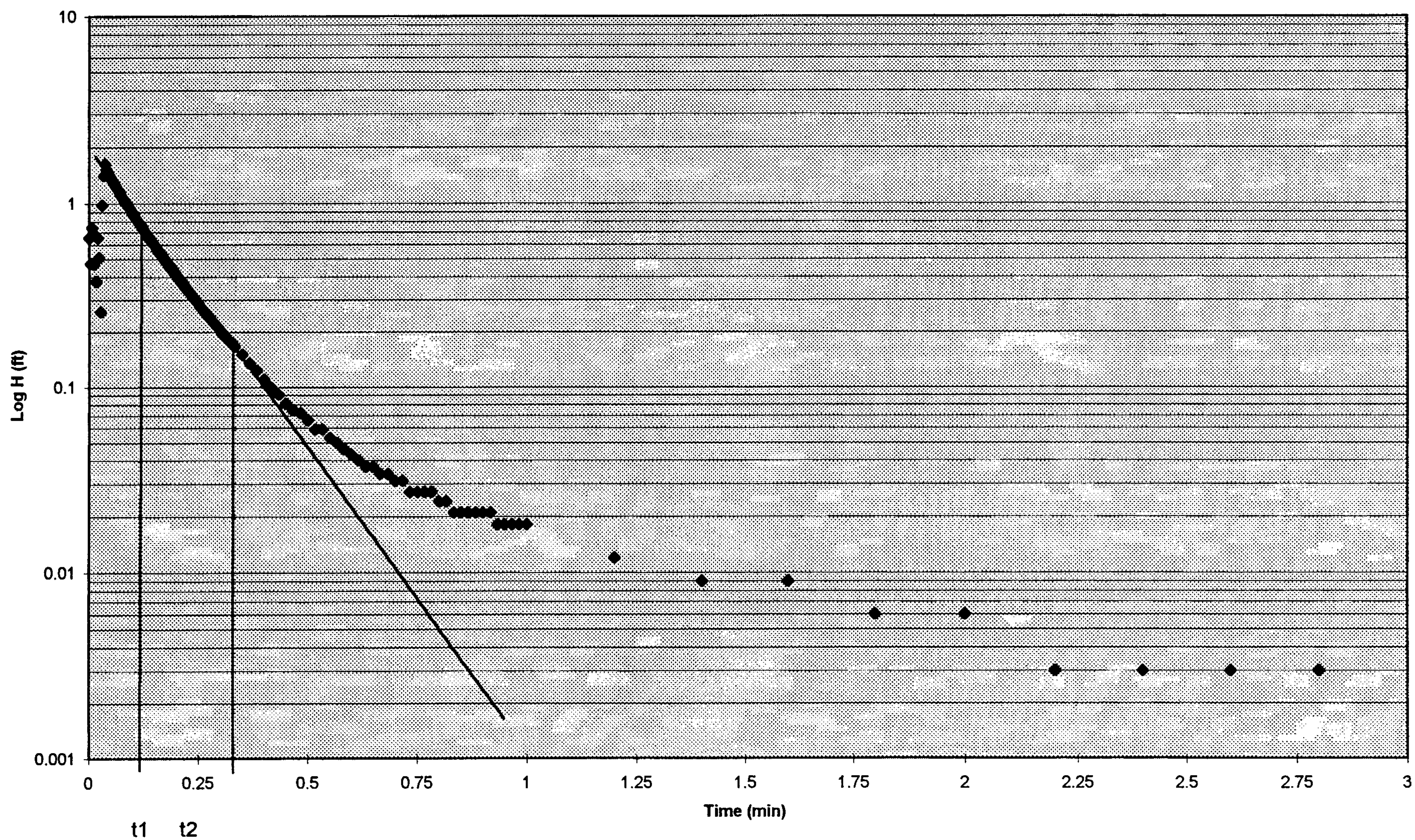
Well ID: 57M-95-04A
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 2.4-12.4 ft.
Water Column Height: 10.15 ft.

Time (min)	delta H (ft.)
0	0.654
0.0033	0.474
0.0066	0.743
0.01	0.471
0.0133	0.677
0.0166	0.379
0.02	0.654
0.0233	0.512
0.0266	0.259
0.03	0.984
0.0333	1.414
0.0366	1.633
0.04	1.525
0.0433	1.471
0.0466	1.424
0.05	1.38
0.0533	1.338
0.0566	1.294
0.06	1.256
0.0633	1.212
0.0666	1.186
0.07	1.148
0.0733	1.114
0.0766	1.082
0.08	1.05
0.0833	1.022
0.0866	0.993
0.09	0.965
0.0933	0.939
0.0966	0.914
0.1	0.889
0.1033	0.867
0.1066	0.841
0.11	0.819
0.1133	0.794
0.1166	0.775
0.12	0.756
0.1233	0.734
0.1266	0.715
0.13	0.696
0.1333	0.677
0.1366	0.661
0.14	0.642
0.1433	0.629
0.1466	0.61
0.15	0.597
0.1533	0.582
0.1566	0.566
0.16	0.55
0.1633	0.537

Time (min)	delta H (ft.)					
0.1666	0.525					
0.17	0.509					
0.1733	0.496					
0.1766	0.483					
0.18	0.474					
0.1833	0.461					
0.1866	0.449					
0.19	0.439					
0.1933	0.426					
0.1966	0.417					
0.2	0.407					
0.2033	0.395					
0.2066	0.389					
0.21	0.379					
0.2133	0.369					
0.2166	0.36					
0.22	0.35					
0.2233	0.344					
0.2266	0.335					
0.23	0.328					
0.2333	0.322					
0.2366	0.313					
0.24	0.306					
0.2433	0.3					
0.2466	0.293					
0.25	0.287					
0.2533	0.278					
0.2566	0.271					
0.26	0.265					
0.2633	0.259					
0.2666	0.255					
0.27	0.249					
0.2733	0.243					
0.2766	0.24					
0.28	0.233					
0.2833	0.227					
0.2866	0.224					
0.29	0.217					
0.2933	0.214					
0.2966	0.211					
0.3	0.205					
0.3033	0.198					
0.3066	0.195					
0.31	0.192					
0.3133	0.186					
0.3166	0.183					
0.32	0.179					
0.3233	0.176					
0.3266	0.176					
0.33	0.17					

Time (min)	delta H (ft.)					
0.3333	0.167					
0.35	0.151					
0.3666	0.135					
0.3833	0.123					
0.4	0.11					
0.4166	0.1					
0.4333	0.091					
0.45	0.081					
0.4666	0.075					
0.4833	0.072					
0.5	0.066					
0.5166	0.059					
0.5333	0.059					
0.55	0.053					
0.5666	0.05					
0.5833	0.046					
0.6	0.043					
0.6166	0.04					
0.6333	0.037					
0.65	0.037					
0.6666	0.034					
0.6833	0.034					
0.7	0.031					
0.7166	0.031					
0.7333	0.027					
0.75	0.027					
0.7666	0.027					
0.7833	0.027					
0.8	0.024					
0.3166	0.024					
0.8333	0.021					
0.85	0.021					
0.8666	0.021					
0.8833	0.021					
0.9	0.021					
0.9166	0.021					
0.9333	0.018					
0.95	0.018					
0.9666	0.018					
0.9833	0.018					
1	0.018					
1.2	0.012					
1.4	0.009					
1.6	0.009					
1.8	0.006					
2	0.006					
2.2	0.003					
2.4	0.003					
2.6	0.003					
2.8	0.003					

57M-95-04A RISING HEAD



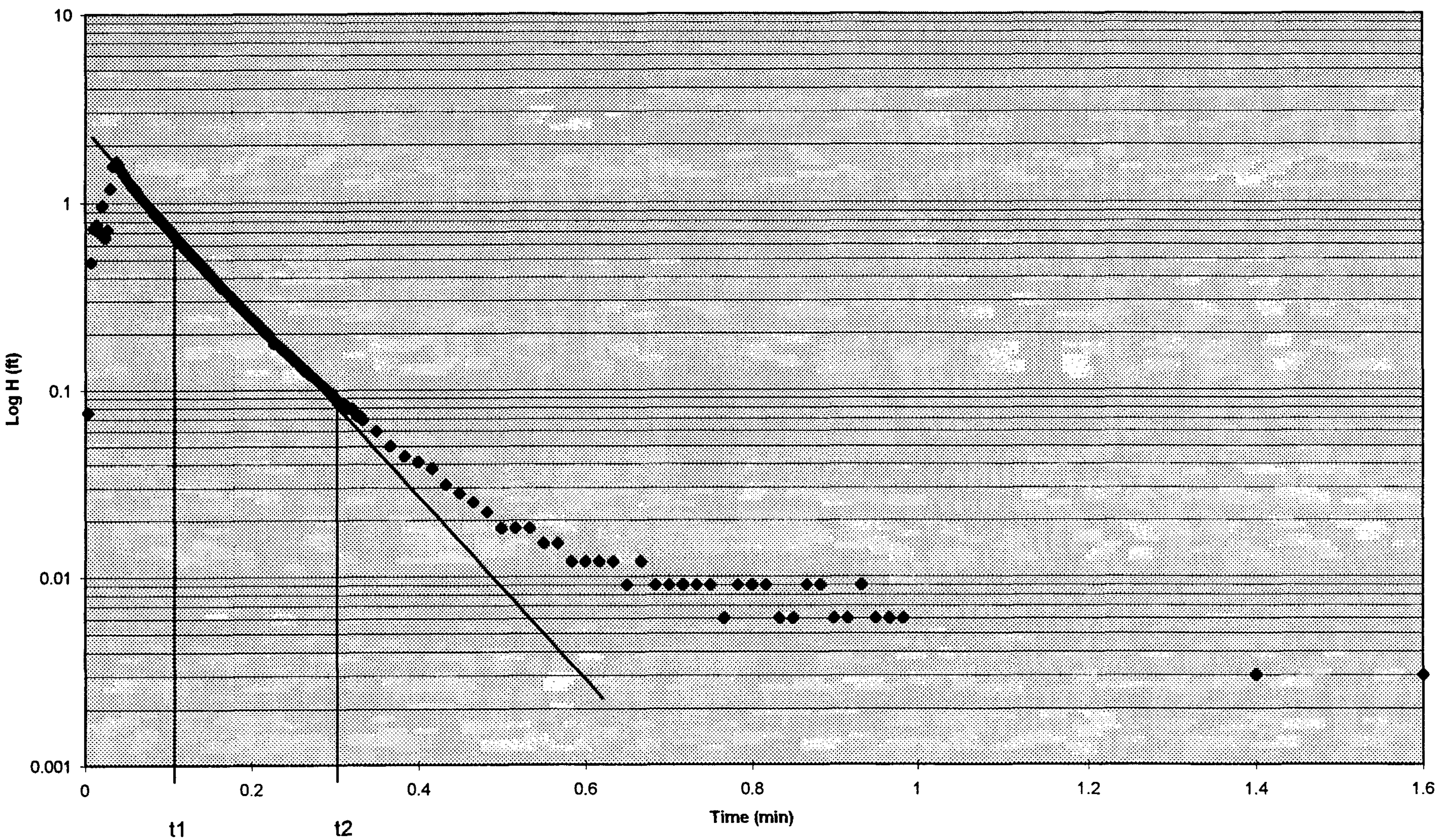
Well ID: 57M-95-04B
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 18.5-28.5 ft.
Water Column Height: 27.31 ft.

Time (min)	delta H (ft.)
0.0033	0.076
0.0066	0.487
0.01	0.731
0.0133	0.766
0.0166	0.706
0.02	0.962
0.0233	0.661
0.0266	0.725
0.03	1.184
0.0333	1.545
0.0366	1.633
0.04	1.573
0.0433	1.475
0.0466	1.396
0.05	1.326
0.0533	1.269
0.0566	1.216
0.06	1.168
0.0633	1.121
0.0666	1.076
0.07	1.035
0.0733	0.997
0.0766	0.956
0.08	0.924
0.0833	0.874
0.0866	0.861
0.09	0.81
0.0933	0.785
0.0966	0.753
0.1	0.725
0.1033	0.696
0.1066	0.671
0.11	0.639
0.1133	0.62
0.1166	0.601
0.12	0.573
0.1233	0.557
0.1266	0.535
0.13	0.513
0.1333	0.497
0.1366	0.478
0.14	0.465
0.1433	0.446
0.1466	0.427
0.15	0.411
0.1533	0.399
0.1566	0.383
0.16	0.37
0.1633	0.354
0.1666	0.348

Time (min)	delta H (ft.)					
0.17	0.335					
0.1733	0.323					
0.1766	0.313					
0.18	0.297					
0.1833	0.288					
0.1866	0.275					
0.19	0.269					
0.1933	0.259					
0.1966	0.25					
0.2	0.243					
0.2033	0.234					
0.2066	0.228					
0.21	0.218					
0.2133	0.212					
0.2166	0.202					
0.22	0.199					
0.2233	0.19					
0.2266	0.177					
0.23	0.177					
0.2333	0.171					
0.2366	0.164					
0.24	0.161					
0.2433	0.155					
0.2466	0.152					
0.25	0.145					
0.2533	0.142					
0.2566	0.139					
0.26	0.133					
0.2633	0.126					
0.2666	0.126					
0.27	0.12					
0.2733	0.117					
0.2766	0.114					
0.28	0.11					
0.2833	0.107					
0.2866	0.104					
0.29	0.101					
0.2933	0.098					
0.2966	0.095					
0.3	0.091					
0.3033	0.088					
0.3066	0.085					
0.31	0.085					
0.3133	0.079					
0.3166	0.079					
0.32	0.079					
0.3233	0.076					
0.3266	0.072					
0.33	0.072					
0.3333	0.069					

Time (min)	delta H (ft.)					
0.35	0.06					
0.3666	0.05					
0.3833	0.044					
0.4	0.041					
0.4166	0.038					
0.4333	0.031					
0.45	0.028					
0.4666	0.025					
0.4833	0.022					
0.5	0.018					
0.5166	0.018					
0.5333	0.018					
0.55	0.015					
0.5666	0.015					
0.5833	0.012					
0.6	0.012					
0.6166	0.012					
0.6333	0.012					
0.65	0.009					
0.6666	0.012					
0.6833	0.009					
0.7	0.009					
0.7166	0.009					
0.7333	0.009					
0.75	0.009					
0.7666	0.006					
0.7833	0.009					
0.8	0.009					
0.8166	0.009					
0.8333	0.006					
0.85	0.006					
0.8666	0.009					
0.8833	0.009					
0.9	0.006					
0.9166	0.006					
0.9333	0.009					
0.95	0.006					
0.9666	0.006					
0.9833	0.006					
1.4	0.003					
1.6	0.003					

57M-95-04B RISING HEAD



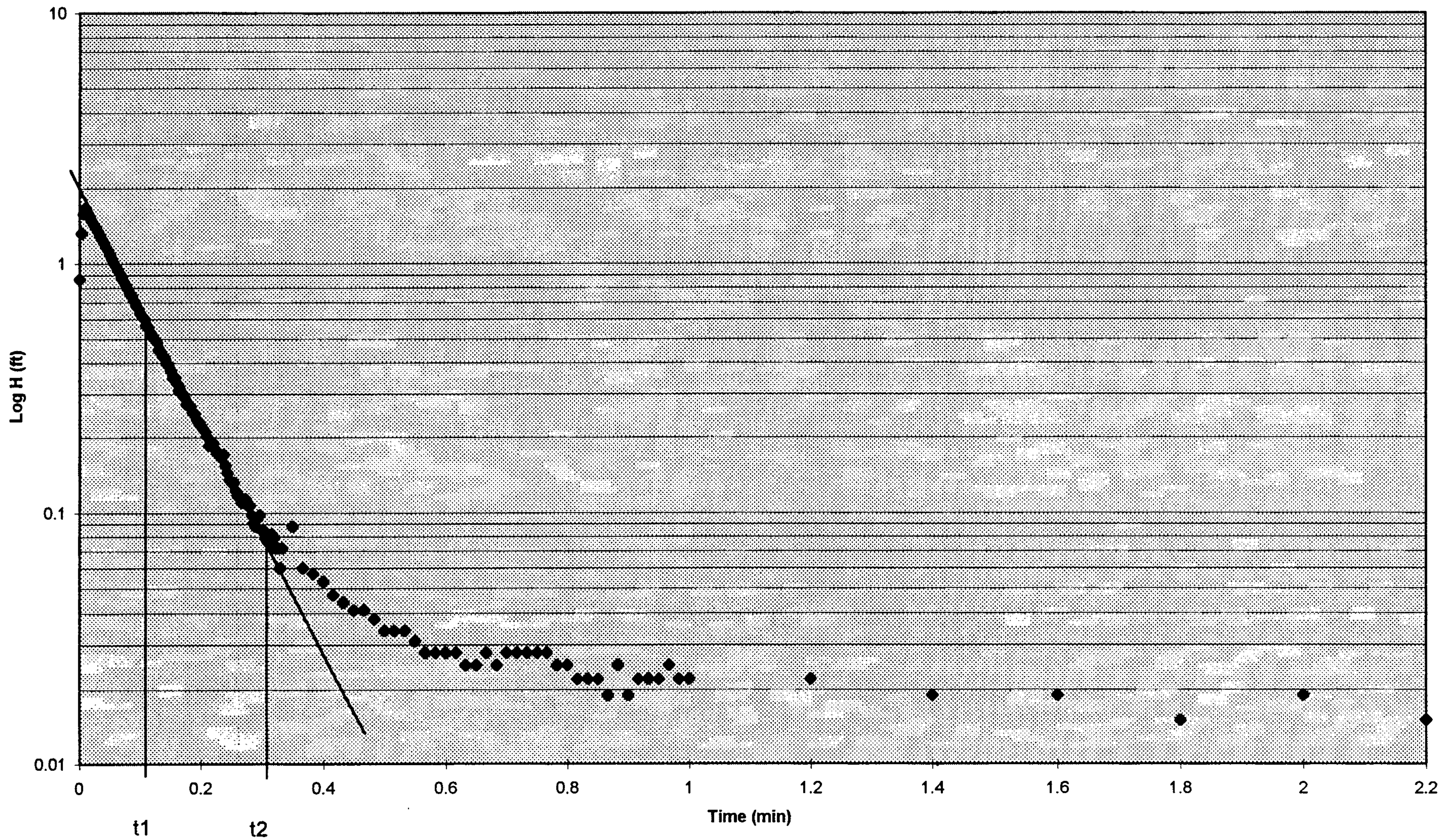
Well ID: 57M-95-05X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 10-20 ft.
Water Column Height: 7.09 ft.

Time (min)	delta H (ft.)
0	0.867
0.0033	1.323
0.0066	1.583
0.01	1.675
0.0133	1.583
0.0166	1.535
0.02	1.485
0.0233	1.437
0.0266	1.393
0.03	1.348
0.0333	1.295
0.0366	1.253
0.04	1.215
0.0433	1.168
0.0466	1.139
0.05	1.089
0.0533	1.048
0.0566	1.013
0.06	0.981
0.0633	0.949
0.0666	0.915
0.07	0.88
0.0733	0.851
0.0766	0.823
0.08	0.791
0.0833	0.76
0.0866	0.741
0.09	0.712
0.0933	0.68
0.0966	0.664
0.1	0.63
0.1033	0.617
0.1066	0.601
0.11	0.563
0.1133	0.554
0.1166	0.531
0.12	0.516
0.1233	0.5
0.1266	0.49
0.13	0.452
0.1333	0.443
0.1366	0.427
0.14	0.421
0.1433	0.399
0.1466	0.389
0.15	0.373
0.1533	0.348
0.1566	0.351
0.16	0.332
0.1633	0.31

Time (min)	delta H (ft.)					
0.1666	0.31					
0.17	0.3					
0.1733	0.291					
0.1766	0.272					
0.18	0.272					
0.1833	0.266					
0.1866	0.253					
0.19	0.25					
0.1933	0.237					
0.1966	0.231					
0.2	0.224					
0.2033	0.218					
0.2066	0.212					
0.21	0.202					
0.2133	0.186					
0.2166	0.19					
0.22	0.19					
0.2233	0.18					
0.2266	0.174					
0.23	0.171					
0.2333	0.167					
0.2366	0.171					
0.24	0.155					
0.2433	0.145					
0.2466	0.136					
0.25	0.133					
0.2533	0.133					
0.2566	0.123					
0.26	0.117					
0.2633	0.117					
0.2666	0.11					
0.27	0.11					
0.2733	0.114					
0.2766	0.107					
0.28	0.107					
0.2833	0.098					
0.2866	0.091					
0.29	0.088					
0.2933	0.095					
0.2966	0.098					
0.3	0.085					
0.3033	0.085					
0.3066	0.079					
0.31	0.076					
0.3133	0.079					
0.3166	0.082					
0.32	0.079					
0.3233	0.072					
0.3266	0.072					
0.33	0.06					

Time (min)	delta H (ft.)					
0.3333	0.072					
0.35	0.088					
0.3666	0.06					
0.3833	0.057					
0.4	0.053					
0.4166	0.047					
0.4333	0.044					
0.45	0.041					
0.4666	0.041					
0.4833	0.038					
0.5	0.034					
0.5166	0.034					
0.5333	0.034					
0.55	0.031					
0.5666	0.028					
0.5833	0.028					
0.6	0.028					
0.6166	0.028					
0.6333	0.025					
0.65	0.025					
0.6666	0.028					
0.6833	0.025					
0.7	0.028					
0.7166	0.028					
0.7333	0.028					
0.75	0.028					
0.7666	0.028					
0.7833	0.025					
0.8	0.025					
0.8166	0.022					
0.8333	0.022					
0.85	0.022					
0.8666	0.019					
0.8833	0.025					
0.9	0.019					
0.9166	0.022					
0.9333	0.022					
0.95	0.022					
0.9666	0.025					
0.9833	0.022					
1	0.022					
1.2	0.022					
1.4	0.019					
1.6	0.019					
1.8	0.015					
2	0.019					
2.2	0.015					

57M-95-05X RISING HEAD



Well ID: 57M-95-06X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 11.9-21.9 ft.
Water Column Height: 11.22 ft.

Time (min)	delta H (ft.)
0	0.13
0.0033	0.424
0.0066	0.674
0.01	0.171
0.0133	0.393
0.0166	0.374
0.02	1.091
0.0233	1.009
0.0266	0.886
0.03	1.566
0.0333	1.817
0.0366	1.722
0.04	1.817
0.0433	1.788
0.0466	1.769
0.05	1.759
0.0533	1.744
0.0566	1.725
0.06	1.725
0.0633	1.699
0.0666	1.68
0.07	1.671
0.0733	1.652
0.0766	1.636
0.08	1.627
0.0833	1.614
0.0866	1.598
0.09	1.582
0.0933	1.57
0.0966	1.557
0.1	1.544
0.1033	1.525
0.1066	1.516
0.11	1.503
0.1133	1.497
0.1166	1.484
0.12	1.471
0.1233	1.462
0.1266	1.433
0.13	1.433
0.1333	1.424
0.1366	1.411
0.14	1.399
0.1433	1.386
0.1466	1.373
0.15	1.364
0.1533	1.364
0.1566	1.351
0.16	1.326
0.1633	1.322

Time (min)	delta H (ft.)					
0.1666	1.313					
0.17	1.304					
0.1733	1.291					
0.1766	1.278					
0.18	1.266					
0.1833	1.256					
0.1866	1.253					
0.19	1.243					
0.1933	1.227					
0.1966	1.218					
0.2	1.209					
0.2033	1.205					
0.2066	1.19					
0.21	1.183					
0.2133	1.17					
0.2166	1.164					
0.22	1.155					
0.2233	1.145					
0.2266	1.139					
0.23	1.114					
0.2333	1.123					
0.2366	1.107					
0.24	1.107					
0.2433	1.091					
0.2466	1.088					
0.25	1.076					
0.2533	1.069					
0.2566	1.06					
0.26	1.053					
0.2633	1.041					
0.2666	1.041					
0.27	1.025					
0.2733	1.019					
0.2766	1.012					
0.28	1.006					
0.2833	0.994					
0.2866	0.991					
0.29	0.988					
0.2933	0.978					
0.2966	0.966					
0.3	0.956					
0.3033	0.95					
0.3066	0.947					
0.31	0.94					
0.3133	0.943					
0.3166	0.921					
0.32	0.915					
0.3233	0.909					
0.3266	0.896					
0.33	0.893					

Time (min)	delta H (ft.)					
0.3333	0.89					
0.35	0.852					
0.3666	0.823					
0.3833	0.788					
0.4	0.754					
0.4166	0.731					
0.4333	0.697					
0.45	0.678					
0.4666	0.646					
0.4833	0.624					
0.5	0.589					
0.5166	0.564					
0.5333	0.548					
0.55	0.526					
0.5666	0.51					
0.5833	0.494					
0.6	0.472					
0.6166	0.453					
0.6333	0.434					
0.65	0.424					
0.6666	0.408					
0.6833	0.393					
0.7	0.367					
0.7166	0.358					
0.7333	0.348					
0.75	0.326					
0.7666	0.323					
0.7833	0.313					
0.8	0.298					
0.8166	0.288					
0.8333	0.279					
0.85	0.272					
0.8666	0.26					
0.8833	0.25					
0.9	0.247					
0.9166	0.234					
0.9333	0.225					
0.95	0.218					
0.9666	0.212					
0.9833	0.203					
1	0.199					
1.2	0.123					
1.4	0.089					
1.6	0.066					
1.8	0.051					
2	0.038					
2.2	0.035					
2.4	0.028					
2.6	0.025					
2.8	0.025					

Time (min)	delta H (ft.)					
3	0.022					
3.2	0.022					
3.4	0.019					
3.6	0.022					
3.8	0.019					
4	0.019					
4.2	0.016					

Well ID: 57M-95-07X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 3-13 ft.
Water Column Height: 11.37 ft.

Time (min)	delta H (ft.)
0.0066	0.003
0.01	0.003
0.0133	0.006
0.0166	0.066
0.0266	0.063
0.03	0.145
0.0466	0.057
0.0533	0.262
0.0566	0.332
0.0666	0.139
0.0733	0.547
0.0766	1.868
0.08	0.224
0.0833	0.927
0.0866	0.737
0.09	1.532
0.0933	0.696
0.0966	0.756
0.1	0.744
0.1033	0.627
0.1066	0.525
0.11	0.639
0.1133	1.402
0.1166	0.886
0.12	1.453
0.1233	1.298
0.1266	1.272
0.13	1.215
0.1333	1.165
0.1366	1.117
0.14	1.073
0.1433	1.035
0.1466	0.994
0.15	0.956
0.1533	0.918
0.1566	0.886
0.16	0.851
0.1633	0.82
0.1666	0.791
0.17	0.76
0.1733	0.734
0.1766	0.706
0.18	0.68
0.1833	0.658
0.1866	0.633
0.19	0.611
0.1933	0.592
0.1966	0.57
0.2	0.551
0.2033	0.531

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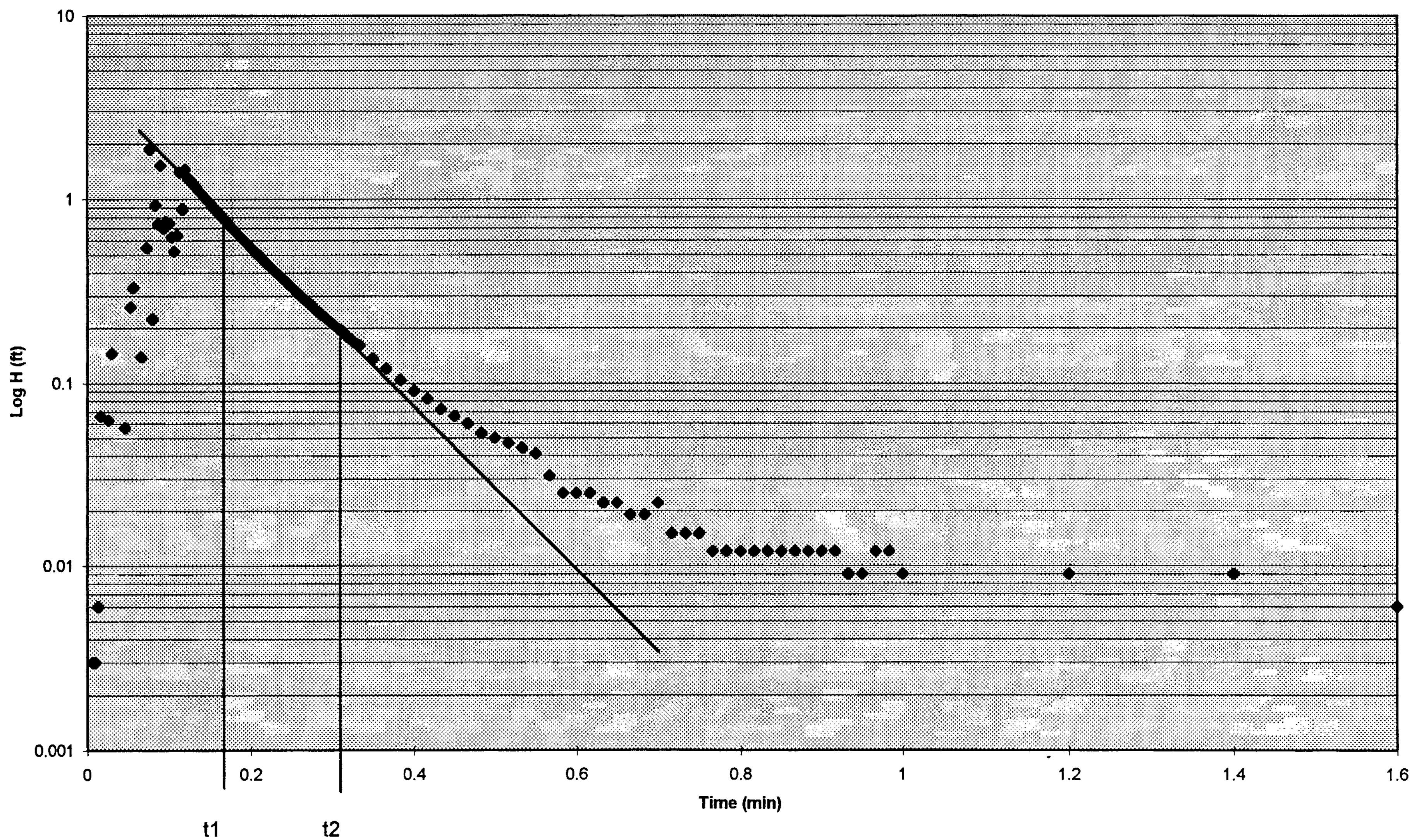
DOCUMENT

2

Time (min)	delta H (ft.)					
0.5333	0.044					
0.55	0.041					
0.5666	0.031					
0.5833	0.025					
0.6	0.025					
0.6166	0.025					
0.6333	0.022					
0.65	0.022					
0.6666	0.019					
0.6833	0.019					
0.7	0.022					
0.7166	0.015					
0.7333	0.015					
0.75	0.015					
0.7666	0.012					
0.7833	0.012					
0.8	0.012					
0.8166	0.012					
0.8333	0.012					
0.85	0.012					
0.8666	0.012					
0.8833	0.012					
0.9	0.012					
0.9166	0.012					
0.9333	0.009					
0.95	0.009					
0.9666	0.012					
0.9833	0.012					
1	0.009					
1.2	0.009					
1.4	0.009					
1.6	0.006					

57M-95-07X RISING HEAD



Well ID: 57M-95-08A
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 3-13 ft.
Water Column Height: 11.32 ft.

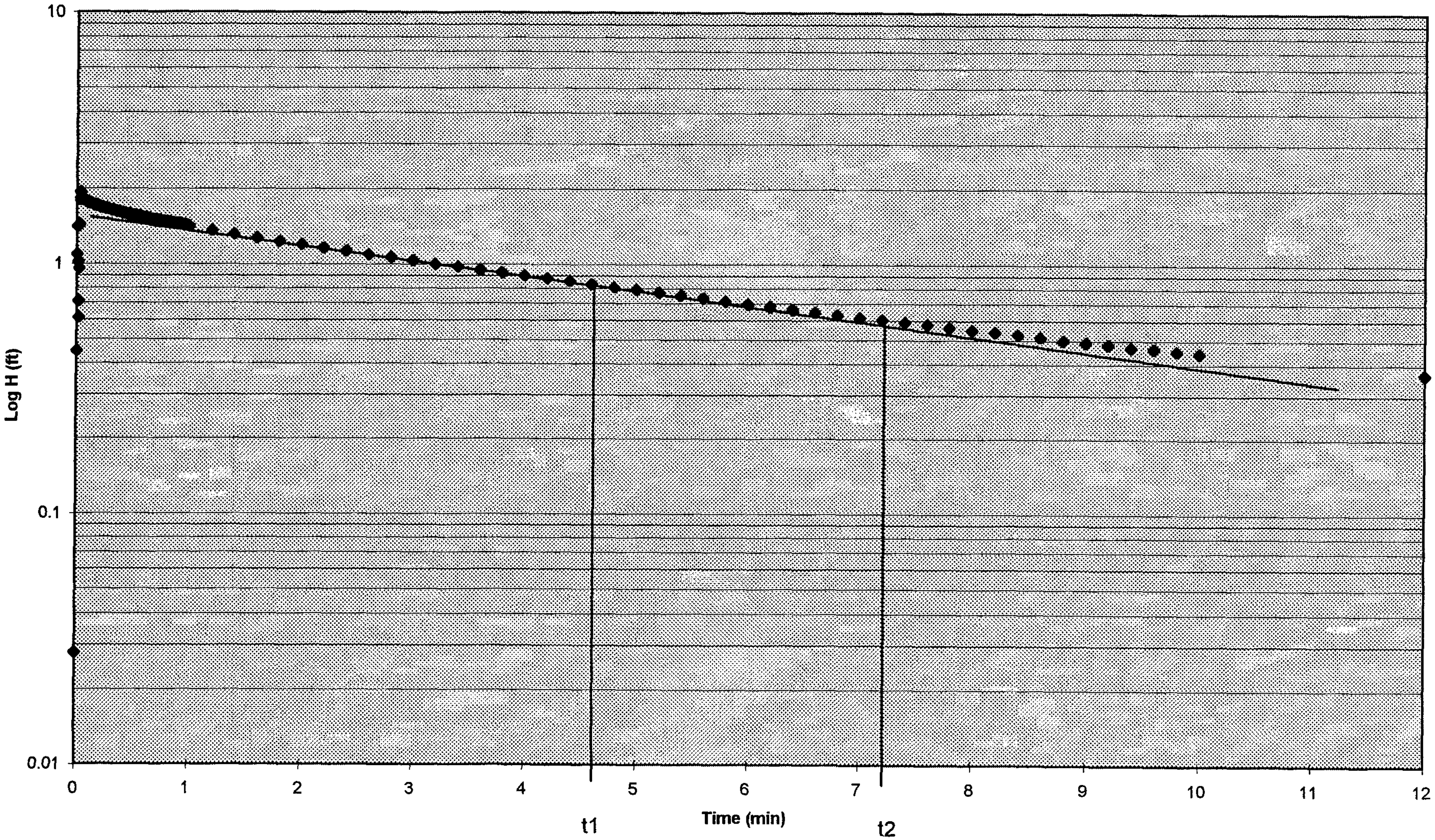
Time (min)	delta H (ft.)
0	0.028
0.0033	0.449
0.0066	1.095
0.01	1.418
0.0133	1.022
0.0166	0.709
0.02	0.611
0.0233	0.959
0.0266	1.44
0.03	1.941
0.0333	1.83
0.0366	1.808
0.04	1.823
0.0433	1.817
0.0466	1.814
0.05	1.811
0.0533	1.811
0.0566	1.811
0.06	1.801
0.0633	1.804
0.0666	1.798
0.07	1.798
0.0733	1.795
0.0766	1.792
0.08	1.785
0.0833	1.785
0.0866	1.776
0.09	1.776
0.0933	1.77
0.0966	1.763
0.1	1.763
0.1033	1.76
0.1066	1.757
0.11	1.754
0.1133	1.754
0.1166	1.751
0.12	1.751
0.1233	1.747
0.1266	1.744
0.13	1.741
0.1333	1.741
0.1366	1.738
0.14	1.735
0.1433	1.728
0.1466	1.728
0.15	1.725
0.1533	1.722
0.1566	1.722
0.16	1.719
0.1633	1.719

Time (min)	delta H (ft.)					
0.1666	1.716					
0.17	1.713					
0.1733	1.709					
0.1766	1.709					
0.18	1.709					
0.1833	1.706					
0.1866	1.706					
0.19	1.703					
0.1933	1.7					
0.1966	1.7					
0.2	1.697					
0.2033	1.694					
0.2066	1.694					
0.21	1.69					
0.2133	1.69					
0.2166	1.687					
0.22	1.687					
0.2233	1.684					
0.2266	1.684					
0.23	1.681					
0.2333	1.681					
0.2366	1.678					
0.24	1.675					
0.2433	1.675					
0.2466	1.671					
0.25	1.671					
0.2533	1.668					
0.2566	1.668					
0.26	1.668					
0.2633	1.665					
0.2666	1.665					
0.27	1.662					
0.2733	1.659					
0.2766	1.659					
0.28	1.656					
0.2833	1.656					
0.2866	1.656					
0.29	1.652					
0.2933	1.652					
0.2966	1.649					
0.3	1.649					
0.3033	1.649					
0.3066	1.643					
0.31	1.643					
0.3133	1.643					
0.3166	1.643					
0.32	1.64					
0.3233	1.637					
0.3266	1.637					
0.33	1.637					

Time (min)	delta H (ft.)					
0.3333	1.633					
0.35	1.627					
0.3666	1.621					
0.3833	1.611					
0.4	1.605					
0.4166	1.599					
0.4333	1.592					
0.45	1.586					
0.4666	1.58					
0.4833	1.573					
0.5	1.567					
0.5166	1.564					
0.5333	1.557					
0.55	1.551					
0.5666	1.545					
0.5833	1.538					
0.6	1.532					
0.6166	1.529					
0.6333	1.523					
0.65	1.519					
0.6666	1.513					
0.6833	1.507					
0.7	1.504					
0.7166	1.5					
0.7333	1.494					
0.75	1.491					
0.7666	1.485					
0.7833	1.481					
0.8	1.478					
0.8166	1.475					
0.8333	1.469					
0.85	1.462					
0.8666	1.459					
0.8833	1.456					
0.9	1.45					
0.9166	1.447					
0.9333	1.44					
0.95	1.437					
0.9666	1.434					
0.9833	1.431					
1	1.424					
1.2	1.364					
1.4	1.32					
1.6	1.279					
1.8	1.238					
2	1.2					
2.2	1.165					
2.4	1.13					
2.6	1.095					
2.8	1.063					

Time (min)	delta H (ft.)					
3	1.035					
3.2	1.003					
3.4	0.978					
3.6	0.949					
3.8	0.927					
4	0.899					
4.2	0.877					
4.4	0.854					
4.6	0.832					
4.8	0.807					
5	0.788					
5.2	0.769					
5.4	0.75					
5.6	0.731					
5.8	0.712					
6	0.693					
6.2	0.677					
6.4	0.661					
6.6	0.645					
6.8	0.63					
7	0.614					
7.2	0.601					
7.4	0.588					
7.6	0.576					
7.8	0.56					
8	0.547					
8.2	0.538					
8.4	0.525					
8.6	0.513					
8.8	0.5					
9	0.49					
9.2	0.481					
9.4	0.468					
9.6	0.462					
9.8	0.452					
10	0.443					
12	0.364					

57M-95-08A RISING HEAD



Well ID: 57M-95-08B
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 18-28 ft.
Water Column Height: 26.64 ft.

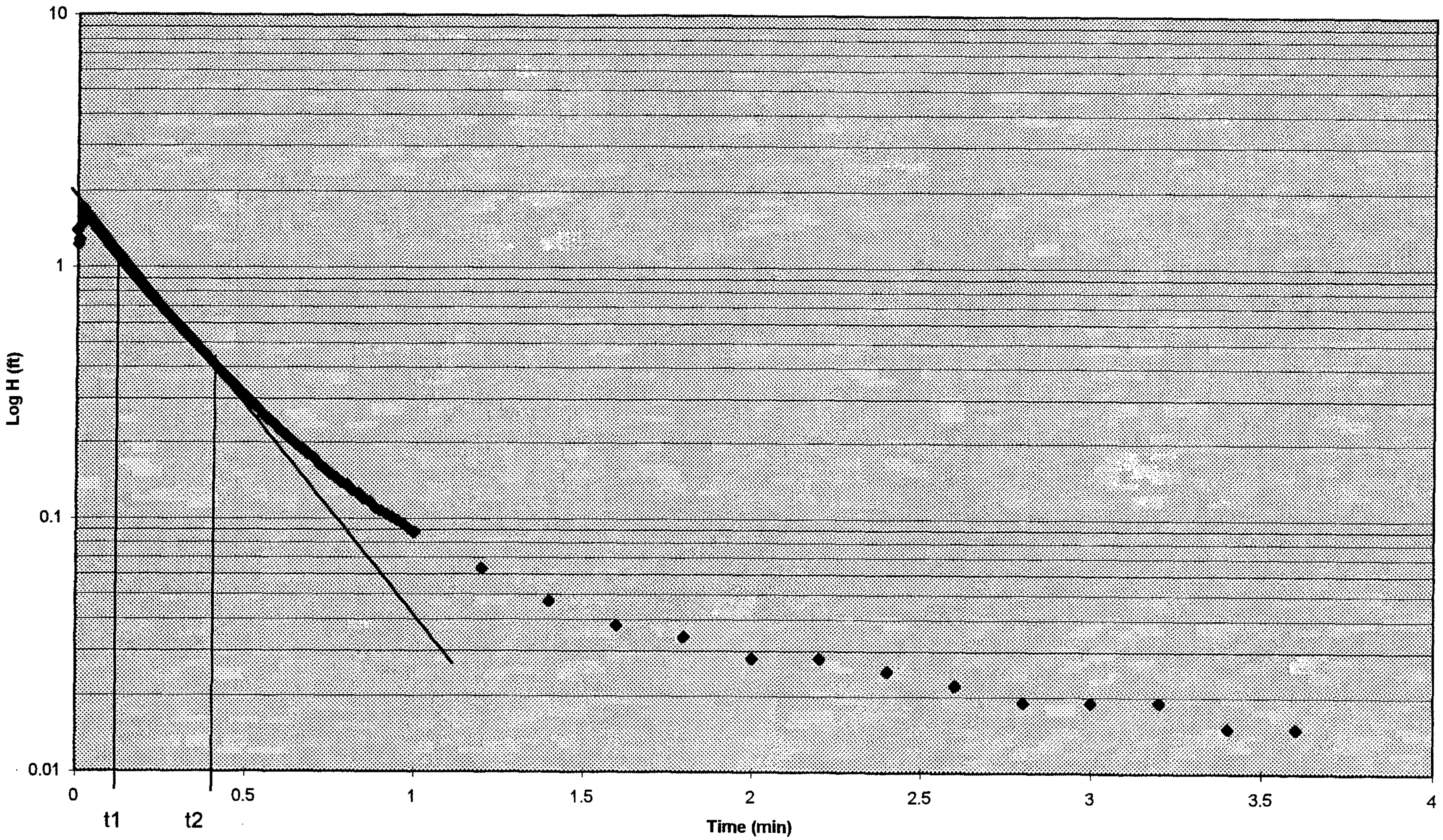
Time (min)	delta H (ft.)
0	1.393
0.0033	1.231
0.0066	1.282
0.01	1.459
0.0133	1.58
0.0166	1.709
0.02	1.694
0.0233	1.64
0.0266	1.605
0.03	1.583
0.0333	1.561
0.0366	1.535
0.04	1.516
0.0433	1.497
0.0466	1.475
0.05	1.456
0.0533	1.44
0.0566	1.418
0.06	1.399
0.0633	1.383
0.0666	1.361
0.07	1.342
0.0733	1.326
0.0766	1.31
0.08	1.292
0.0833	1.272
0.0866	1.257
0.09	1.241
0.0933	1.222
0.0966	1.209
0.1	1.193
0.1033	1.178
0.1066	1.162
0.11	1.146
0.1133	1.133
0.1166	1.117
0.12	1.105
0.1233	1.092
0.1266	1.076
0.13	1.064
0.1333	1.051
0.1366	1.038
0.14	1.022
0.1433	1.013
0.1466	1
0.15	0.987
0.1533	0.975
0.1566	0.962
0.16	0.949
0.1633	0.94

Time (min)	delta H (ft.)					
0.1666	0.927					
0.17	0.918					
0.1733	0.905					
0.1766	0.896					
0.18	0.886					
0.1833	0.877					
0.1866	0.864					
0.19	0.855					
0.1933	0.842					
0.1966	0.832					
0.2	0.823					
0.2033	0.813					
0.2066	0.804					
0.21	0.794					
0.2133	0.785					
0.2166	0.775					
0.22	0.769					
0.2233	0.76					
0.2266	0.75					
0.23	0.744					
0.2333	0.731					
0.2366	0.725					
0.24	0.715					
0.2433	0.709					
0.2466	0.703					
0.25	0.693					
0.2533	0.684					
0.2566	0.674					
0.26	0.668					
0.2633	0.661					
0.2666	0.655					
0.27	0.646					
0.2733	0.639					
0.2766	0.633					
0.28	0.627					
0.2833	0.617					
0.2866	0.611					
0.29	0.604					
0.2933	0.598					
0.2966	0.592					
0.3	0.585					
0.3033	0.579					
0.3066	0.573					
0.31	0.566					
0.3133	0.56					
0.3166	0.554					
0.32	0.547					
0.3233	0.541					
0.3266	0.538					
0.33	0.532					

Time (min)	delta H (ft.)				
0.3333	0.525				
0.35	0.497				
0.3666	0.468				
0.3833	0.443				
0.4	0.418				
0.4166	0.395				
0.4333	0.373				
0.45	0.354				
0.4666	0.338				
0.4833	0.319				
0.5	0.304				
0.5166	0.288				
0.5333	0.275				
0.55	0.259				
0.5666	0.247				
0.5833	0.237				
0.6	0.224				
0.6166	0.215				
0.6333	0.205				
0.65	0.196				
0.6666	0.189				
0.6833	0.18				
0.7	0.174				
0.7166	0.164				
0.7333	0.158				
0.75	0.151				
0.7666	0.145				
0.7833	0.139				
0.8	0.136				
0.8166	0.129				
0.8333	0.126				
0.85	0.12				
0.8666	0.117				
0.8833	0.11				
0.9	0.107				
0.9166	0.104				
0.9333	0.101				
0.95	0.098				
0.9666	0.095				
0.9833	0.091				
1	0.088				
1.2	0.063				
1.4	0.047				
1.6	0.038				
1.8	0.034				
2	0.028				
2.2	0.028				
2.4	0.025				
2.6	0.022				
2.8	0.019				

Time (min)	delta H (ft.)					
3	0.019					
3.2	0.019					
3.4	0.015					
3.6	0.015					

57M-95-08B RISING HEAD

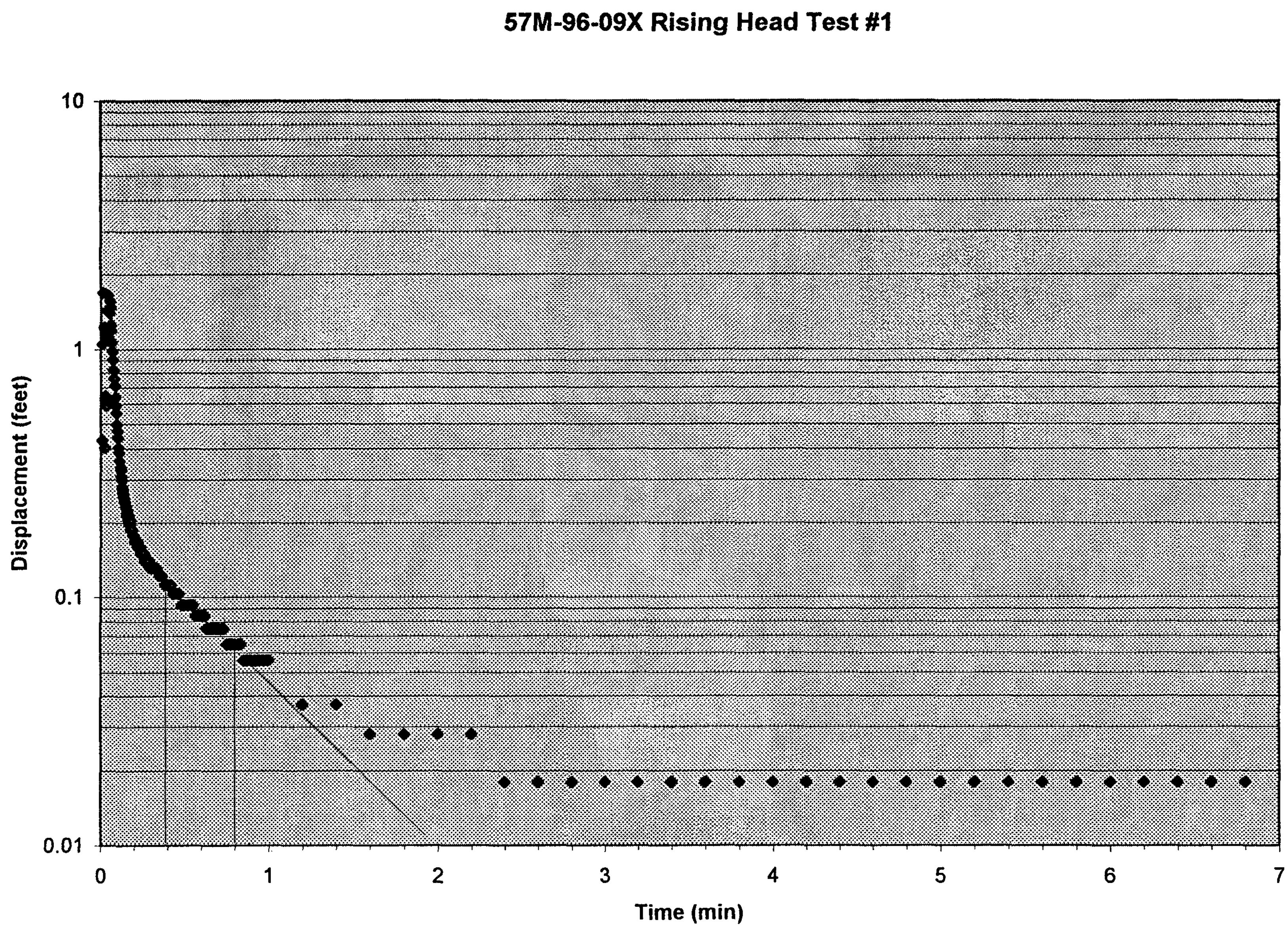


0	0.028	
0.0033	0.028	
0.0066	0	
0.01	0.431	
0.0133	1.051	
0.0166	1.689	
0.02	1.229	
0.0233	0.403	
0.0266	0.647	
0.03	1.135	
0.0333	0.61	
0.0366	0.591	
0.04	1.426	
0.0433	1.661	max. drawdown = 1.661-0.028 = 1.63 ft.
0.0466	1.088	
0.05	1.398	
0.0533	1.567	
0.0566	1.473	
0.06	1.257	
0.0633	1.192	
0.0666	1.069	
0.07	0.985	
0.0733	0.91	
0.0766	0.825	
0.08	0.76	
0.0833	0.713	
0.0866	0.638	
0.09	0.591	
0.0933	0.553	
0.0966	0.497	
0.1	0.469	
0.1033	0.441	
0.1066	0.403	
0.11	0.384	
0.1133	0.356	
0.1166	0.337	
0.12	0.328	
0.1233	0.309	
0.1266	0.3	
0.13	0.281	
0.1333	0.272	
0.1366	0.262	
0.14	0.253	
0.1433	0.244	
0.1466	0.244	
0.15	0.234	
0.1533	0.215	
0.1566	0.225	
0.16	0.215	
0.1633	0.206	
0.1666	0.215	

0.17	0.197
0.1733	0.197
0.1766	0.206
0.18	0.187
0.1833	0.187
0.1866	0.187
0.19	0.178
0.1933	0.178
0.1966	0.178
0.2	0.168
0.2033	0.168
0.2066	0.168
0.21	0.168
0.2133	0.168
0.2166	0.168
0.22	0.159
0.2233	0.159
0.2266	0.159
0.23	0.159
0.2333	0.159
0.2366	0.159
0.24	0.15
0.2433	0.15
0.2466	0.15
0.25	0.15
0.2533	0.15
0.2566	0.15
0.26	0.15
0.2633	0.14
0.2666	0.14
0.27	0.14
0.2733	0.14
0.2766	0.14
0.28	0.14
0.2833	0.14
0.2866	0.14
0.29	0.14
0.2933	0.131
0.2966	0.131
0.3	0.131
0.3033	0.131
0.3066	0.131
0.31	0.131
0.3133	0.131
0.3166	0.131
0.32	0.131
0.3233	0.131
0.3266	0.131
0.33	0.131
0.3333	0.131
0.35	0.122

0.3666	0.122
0.3833	0.112
0.4	0.112
0.4166	0.112
0.4333	0.103
0.45	0.103
0.4666	0.103
0.4833	0.093
0.5	0.093
0.5166	0.093
0.5333	0.093
0.55	0.093
0.5666	0.084
0.5833	0.084
0.6	0.084
0.6166	0.084
0.6333	0.075
0.65	0.075
0.6666	0.075
0.6833	0.075
0.7	0.075
0.7166	0.075
0.7333	0.075
0.75	0.065
0.7666	0.065
0.7833	0.065
0.8	0.065
0.8166	0.065
0.8333	0.065
0.85	0.056
0.8666	0.056
0.8833	0.056
0.9	0.056
0.9166	0.056
0.9333	0.056
0.95	0.056
0.9666	0.056
0.9833	0.056
1	0.056
1.2	0.037
1.4	0.037
1.6	0.028
1.8	0.028
2	0.028
2.2	0.028
2.4	0.018
2.6	0.018
2.8	0.018
3	0.018
3.2	0.018
3.4	0.018

3.6	0.018
3.8	0.018
4	0.018
4.2	0.018
4.4	0.018
4.6	0.018
4.8	0.018
5	0.018
5.2	0.018
5.4	0.018
5.6	0.018
5.8	0.018
6	0.018
6.2	0.018
6.4	0.018
6.6	0.018
6.8	0.018


57M-96-09X Rising Head Test #1
10
1
0.1
0.01
Displacement (feet)
0
1
2
3
4
5
6
7
Time (min)

57M-96-09X Rising Head Test #2

0	0
0.0033	0.009
0.0066	0.065
0.01	1.023
0.0133	0.957
0.0166	0.966
0.02	0.929
0.0233	0.347
0.0266	0.403
0.03	0.825
0.0333	0.591
0.0366	0.938
0.04	1.304 max. drawdown = 1.30 ft
0.0433	1.032
0.0466	0.75
0.05	1.088
0.0533	1.004
0.0566	0.882
0.06	1.051
0.0633	1.192
0.0666	0.994
0.07	1.21
0.0733	1.107
0.0766	0.957
0.08	0.891
0.0833	0.816
0.0866	0.732
0.09	0.685
0.0933	0.628
0.0966	0.572
0.1	0.534
0.1033	0.488
0.1066	0.45
0.11	0.431
0.1133	0.394
0.1166	0.375
0.12	0.356
0.1233	0.328
0.1266	0.319
0.13	0.309
0.1333	0.281
0.1366	0.281
0.14	0.262
0.1433	0.253
0.1466	0.253
0.15	0.244
0.1533	0.234
0.1566	0.225
0.16	0.225
0.1633	0.225
0.1666	0.206

0.17	0.215
0.1733	0.197
0.1766	0.206
0.18	0.187
0.1833	0.197
0.1866	0.178
0.19	0.187
0.1933	0.178
0.1966	0.178
0.2	0.178
0.2033	0.178
0.2066	0.168
0.21	0.168
0.2133	0.168
0.2166	0.168
0.22	0.168
0.2233	0.168
0.2266	0.159
0.23	0.159
0.2333	0.159
0.2366	0.159
0.24	0.159
0.2433	0.159
0.2466	0.159
0.25	0.15
0.2533	0.15
0.2566	0.15
0.26	0.15
0.2633	0.15
0.2666	0.15
0.27	0.14
0.2733	0.14
0.2766	0.14
0.28	0.14
0.2833	0.14
0.2866	0.14
0.29	0.14
0.2933	0.14
0.2966	0.14
0.3	0.14
0.3033	0.131
0.3066	0.131
0.31	0.131
0.3133	0.131
0.3166	0.131
0.32	0.131
0.3233	0.131
0.3266	0.131
0.33	0.131
0.3333	0.122
0.35	0.122

0.3666	0.122
0.3833	0.112
0.4	0.112
0.4166	0.103
0.4333	0.103
0.45	0.103
0.4666	0.103
0.4833	0.093
0.5	0.093
0.5166	0.093
0.5333	0.084
0.55	0.084
0.5666	0.084
0.5833	0.084
0.6	0.084
0.6166	0.084
0.6333	0.075
0.65	0.075
0.6666	0.075
0.6833	0.075
0.7	0.075
0.7166	0.065
0.7333	0.065
0.75	0.065
0.7666	0.065
0.7833	0.065
0.8	0.065
0.8166	0.065
0.8333	0.065
0.85	0.056
0.8666	0.056
0.8833	0.056
0.9	0.056
0.9166	0.056
0.9333	0.056
0.95	0.056
0.9666	0.056
0.9833	0.046
1	0.046
1.2	0.037
1.4	0.028
1.6	0.028
1.8	0.028
2	0.018
2.2	0.018
2.4	0.018
2.6	0.018

THIS
PAGE
IS
MISSING
IN
ORIGINAL
DOCUMENT

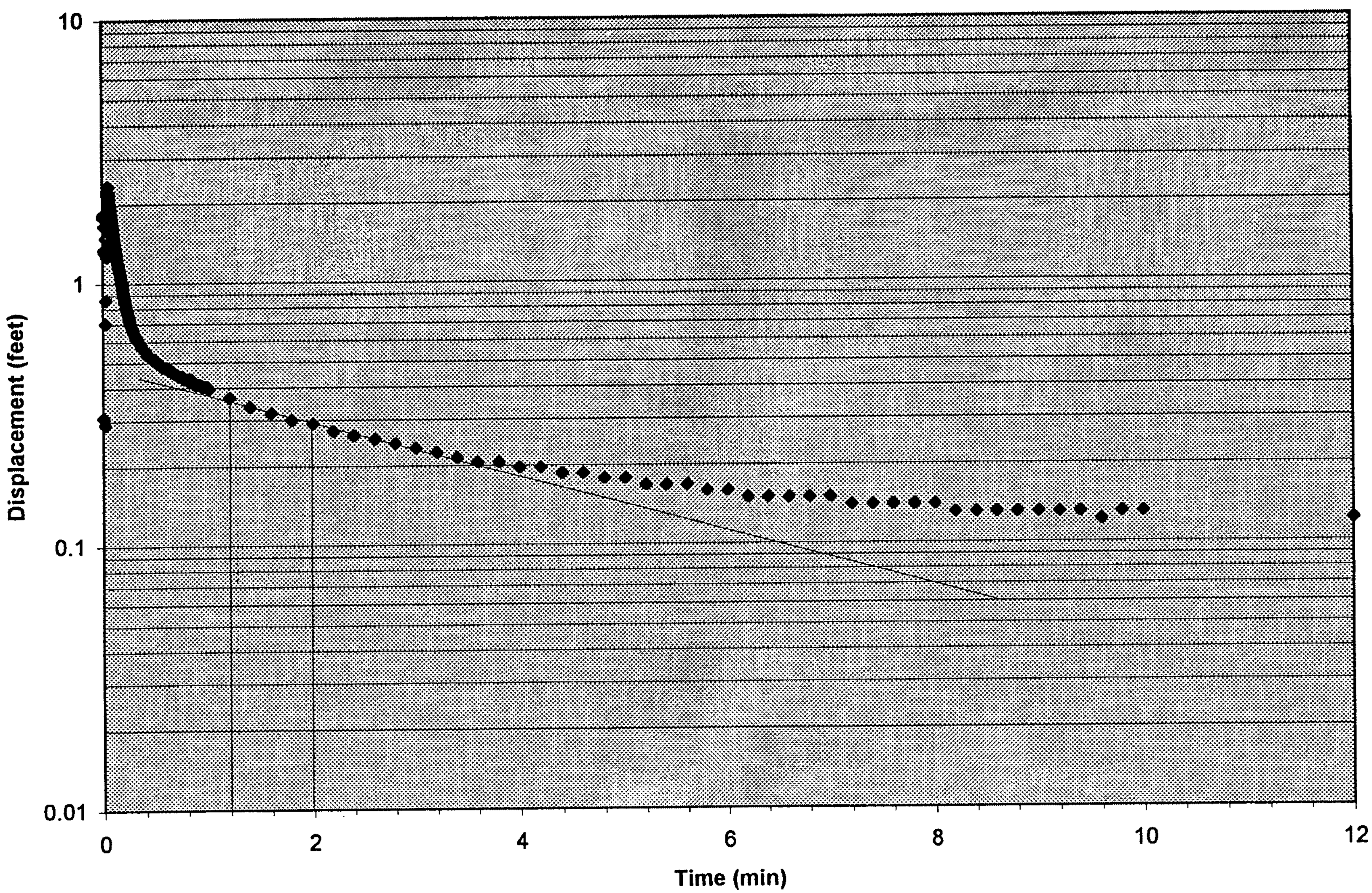
1

0.17	1.06
0.1733	1.041
0.1766	1.023
0.18	1.013
0.1833	0.985
0.1866	0.966
0.19	0.947
0.1933	0.929
0.1966	0.919
0.2	0.901
0.2033	0.882
0.2066	0.872
0.21	0.854
0.2133	0.844
0.2166	0.835
0.22	0.816
0.2233	0.807
0.2266	0.797
0.23	0.788
0.2333	0.779
0.2366	0.769
0.24	0.76
0.2433	0.75
0.2466	0.741
0.25	0.732
0.2533	0.722
0.2566	0.713
0.26	0.703
0.2633	0.703
0.2666	0.694
0.27	0.685
0.2733	0.685
0.2766	0.675
0.28	0.666
0.2833	0.666
0.2866	0.657
0.29	0.647
0.2933	0.647
0.2966	0.638
0.3	0.638
0.3033	0.638
0.3066	0.628
0.31	0.628
0.3133	0.619
0.3166	0.619
0.32	0.619
0.3233	0.61
0.3266	0.61
0.33	0.61
0.3333	0.6
0.35	0.591

0.3666	0.572
0.3833	0.563
0.4	0.553
0.4166	0.534
0.4333	0.534
0.45	0.525
0.4666	0.516
0.4833	0.516
0.5	0.506
0.5166	0.497
0.5333	0.497
0.55	0.488
0.5666	0.478
0.5833	0.478
0.6	0.478
0.6166	0.469
0.6333	0.469
0.65	0.459
0.6666	0.459
0.6833	0.45
0.7	0.45
0.7166	0.441
0.7333	0.441
0.75	0.441
0.7666	0.431
0.7833	0.431
0.8	0.431
0.8166	0.422
0.8333	0.431
0.85	0.422
0.8666	0.412
0.8833	0.412
0.9	0.412
0.9166	0.412
0.9333	0.403
0.95	0.403
0.9666	0.403
0.9833	0.403
1	0.394
1.2	0.366
1.4	0.337
1.6	0.319
1.8	0.3
2	0.29
2.2	0.272
2.4	0.262
2.6	0.253
2.8	0.244
3	0.234
3.2	0.225
3.4	0.215

3.6	0.206
3.8	0.206
4	0.197
4.2	0.197
4.4	0.187
4.6	0.187
4.8	0.178
5	0.178
5.2	0.168
5.4	0.168
5.6	0.168
5.8	0.159
6	0.159
6.2	0.15
6.4	0.15
6.6	0.15
6.8	0.15
7	0.15
7.2	0.14
7.4	0.14
7.6	0.14
7.8	0.14
8	0.14
8.2	0.131
8.4	0.131
8.6	0.131
8.8	0.131
9	0.131
9.2	0.131
9.4	0.131
9.6	0.122
9.8	0.131
10	0.131
12	0.122

57M-96-10X Rising Head Test #1



57M-96-10X Rising Head Test #2

0	2.187
0.0033	2.187
0.0066	2.187
0.01	2.187
0.0133	2.431
0.0166	2.759
0.02	3.35
0.0233	3.566
0.0266	3.482
0.03	3.613
0.0333	3.726
0.0366	3.416
0.04	3.125
0.0433	3.379
0.0466	3.435
0.05	4.43
0.0533	4.27
0.0566	4.392
0.06	4.702
0.0633	4.477
0.0666	4.467
0.07	4.383
0.0733	4.326
0.0766	4.261
0.08	4.214
0.0833	4.158
0.0866	4.139
0.09	4.082
0.0933	4.017
0.0966	3.97
0.1	3.904
0.1033	3.867
0.1066	3.838
0.11	3.792
0.1133	3.754
0.1166	3.716
0.12	3.688
0.1233	3.651
0.1266	3.623
0.13	3.594
0.1333	3.585
0.1366	3.538
0.14	3.519
0.1433	3.501
0.1466	3.472
0.15	3.444
0.1533	3.425
0.1566	3.407
0.16	3.388
0.1633	3.369
0.1666	3.341

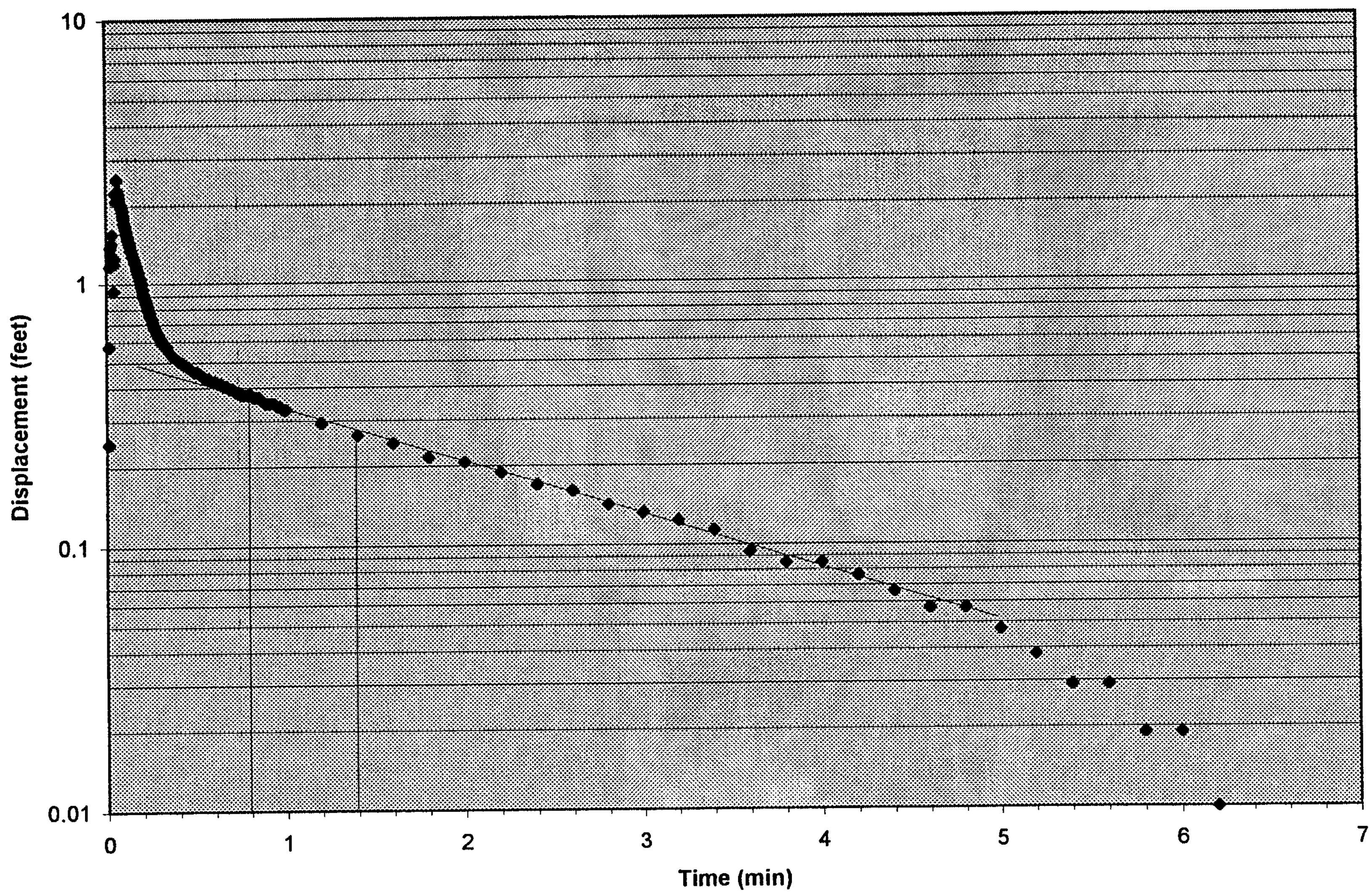
max. drawdown = 4.702 - 2.187 = 2.52 ft.

0.17	3.322
0.1733	3.303
0.1766	3.285
0.18	3.266
0.1833	3.238
0.1866	3.219
0.19	3.2
0.1933	3.172
0.1966	3.153
0.2	3.134
0.2033	3.106
0.2066	3.097
0.21	3.078
0.2133	3.059
0.2166	3.041
0.22	3.031
0.2233	3.012
0.2266	3.003
0.23	2.984
0.2333	2.975
0.2366	2.966
0.24	2.947
0.2433	2.937
0.2466	2.928
0.25	2.919
0.2533	2.9
0.2566	2.9
0.26	2.881
0.2633	2.872
0.2666	2.862
0.27	2.862
0.2733	2.853
0.2766	2.844
0.28	2.834
0.2833	2.825
0.2866	2.825
0.29	2.815
0.2933	2.806
0.2966	2.806
0.3	2.797
0.3033	2.797
0.3066	2.787
0.31	2.778
0.3133	2.778
0.3166	2.778
0.32	2.768
0.3233	2.768
0.3266	2.759
0.33	2.759
0.3333	2.759
0.35	2.731

0.3666	2.712
0.3833	2.703
0.4	2.693
0.4166	2.684
0.4333	2.675
0.45	2.665
0.4666	2.656
0.4833	2.646
0.5	2.646
0.5166	2.637
0.5333	2.628
0.55	2.618
0.5666	2.618
0.5833	2.609
0.6	2.609
0.6166	2.6
0.6333	2.6
0.65	2.59
0.6666	2.59
0.6833	2.581
0.7	2.581
0.7166	2.571
0.7333	2.571
0.75	2.562
0.7666	2.562
0.7833	2.562
0.8	2.562
0.8166	2.553
0.8333	2.553
0.85	2.553
0.8666	2.543
0.8833	2.534
0.9	2.534
0.9166	2.534
0.9333	2.534
0.95	2.524
0.9666	2.524
0.9833	2.515
1	2.515
1.2	2.478
1.4	2.449
1.6	2.431
1.8	2.402
2	2.393
2.2	2.374
2.4	2.355
2.6	2.346
2.8	2.327
3	2.318
3.2	2.309
3.4	2.299

3.6	2.28
3.8	2.271
4	2.271
4.2	2.262
4.4	2.252
4.6	2.243
4.8	2.243
5	2.233
5.2	2.224
5.4	2.215
5.6	2.215
5.8	2.205
6	2.205
6.2	2.196
6.4	2.187
6.6	2.187
6.8	2.177
7	2.177
7.2	2.177
7.4	2.168
7.6	2.158
7.8	2.158
8	2.158
8.2	2.158
8.4	2.149
8.6	2.149
8.8	2.14
9	2.14
9.2	2.13
9.4	2.13
9.6	2.13
9.8	2.121
10	2.121

57M-96-10X Rising Head Test #2



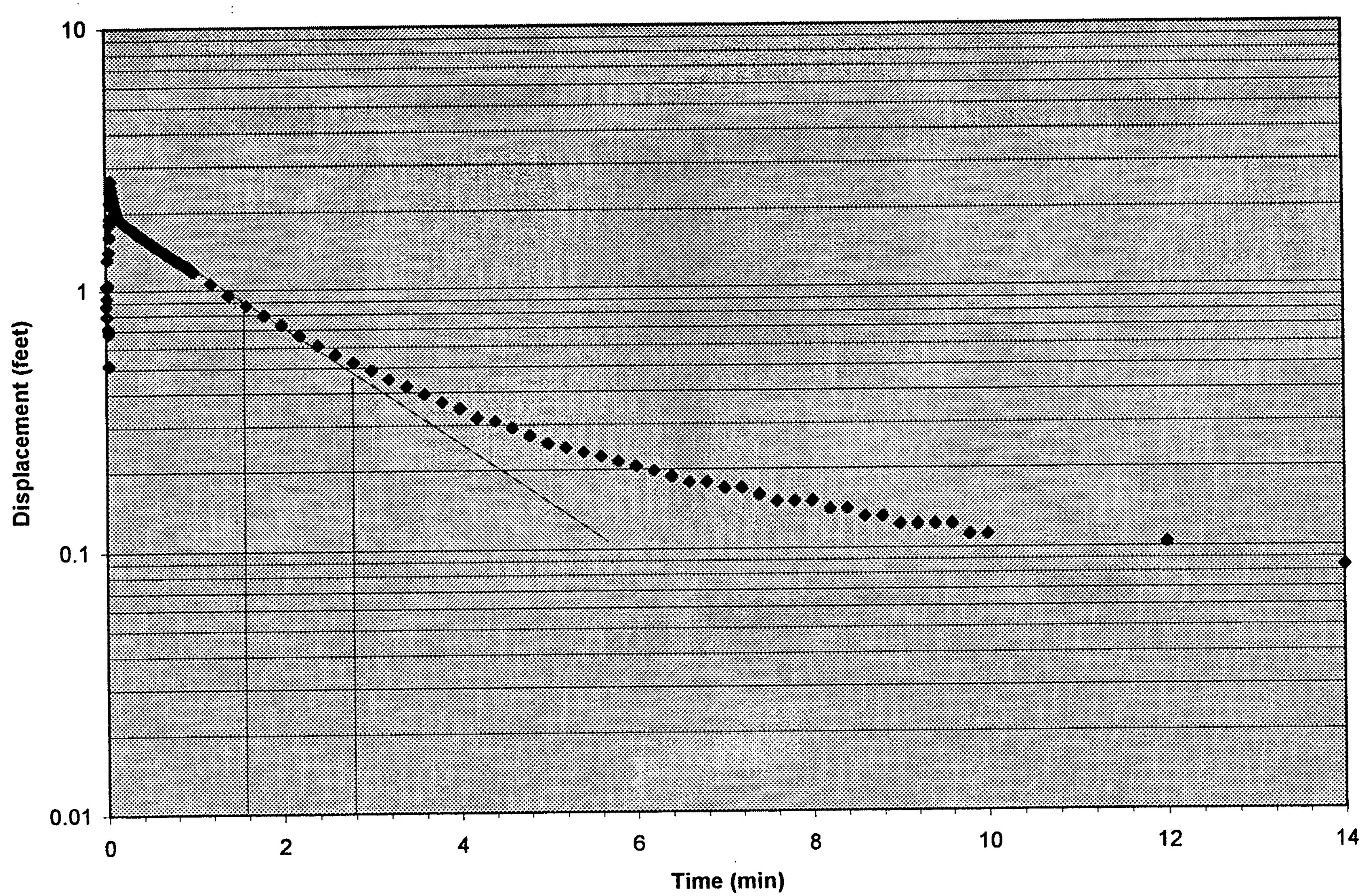
0	0.187	
0.0033	0.872	
0.0066	1.041	
0.01	0.938	
0.0133	0.797	
0.0166	1.032	
0.02	1.323	
0.0233	1.051	
0.0266	0.713	
0.03	0.516	
0.0333	0.685	
0.0366	1.408	
0.04	1.614	
0.0433	1.811	
0.0466	1.905	
0.05	2.196	
0.0533	2.44	
0.0566	2.543	
0.06	2.675	max. drawdown = 2.657 - 0.187 = 2.47 ft.
0.0633	2.459	
0.0666	2.468	
0.07	2.393	
0.0733	2.365	
0.0766	2.318	
0.08	2.28	
0.0833	2.243	
0.0866	2.215	
0.09	2.187	
0.0933	2.158	
0.0966	2.13	
0.1	2.102	
0.1033	2.083	
0.1066	2.065	
0.11	2.036	
0.1133	2.018	
0.1166	1.999	
0.12	1.989	
0.1233	1.971	
0.1266	1.961	
0.13	1.952	
0.1333	1.943	
0.1366	1.933	
0.14	1.924	
0.1433	1.914	
0.1466	1.914	
0.15	1.905	
0.1533	1.896	
0.1566	1.896	
0.16	1.886	
0.1633	1.877	
0.1666	1.877	

0.17	1.867
0.1733	1.858
0.1766	1.858
0.18	1.849
0.1833	1.849
0.1866	1.839
0.19	1.839
0.1933	1.839
0.1966	1.83
0.2	1.83
0.2033	1.821
0.2066	1.821
0.21	1.811
0.2133	1.811
0.2166	1.802
0.22	1.802
0.2233	1.802
0.2266	1.792
0.23	1.792
0.2333	1.783
0.2366	1.783
0.24	1.774
0.2433	1.774
0.2466	1.774
0.25	1.764
0.2533	1.764
0.2566	1.764
0.26	1.755
0.2633	1.755
0.2666	1.745
0.27	1.745
0.2733	1.745
0.2766	1.736
0.28	1.736
0.2833	1.736
0.2866	1.727
0.29	1.727
0.2933	1.727
0.2966	1.717
0.3	1.717
0.3033	1.717
0.3066	1.717
0.31	1.708
0.3133	1.708
0.3166	1.708
0.32	1.698
0.3233	1.698
0.3266	1.698
0.33	1.689
0.3333	1.689
0.35	1.661

0.3666	1.652
0.3833	1.633
0.4	1.623
0.4166	1.605
0.4333	1.586
0.45	1.576
0.4666	1.558
0.4833	1.539
0.5	1.529
0.5166	1.52
0.5333	1.501
0.55	1.492
0.5666	1.473
0.5833	1.464
0.6	1.445
0.6166	1.436
0.6333	1.426
0.65	1.408
0.6666	1.398
0.6833	1.389
0.7	1.37
0.7166	1.37
0.7333	1.351
0.75	1.342
0.7666	1.332
0.7833	1.314
0.8	1.304
0.8166	1.295
0.8333	1.286
0.85	1.276
0.8666	1.267
0.8833	1.257
0.9	1.248
0.9166	1.239
0.9333	1.229
0.95	1.21
0.9666	1.201
0.9833	1.192
1	1.182
1.2	1.06
1.4	0.957
1.6	0.872
1.8	0.797
2	0.732
2.2	0.666
2.4	0.61
2.6	0.563
2.8	0.525
3	0.488
3.2	0.45
3.4	0.422

3.6	0.394
3.8	0.366
4	0.347
4.2	0.319
4.4	0.309
4.6	0.291
4.8	0.272
5	0.253
5.2	0.244
5.4	0.234
5.6	0.225
5.8	0.215
6	0.206
6.2	0.197
6.4	0.187
6.6	0.178
6.8	0.178
7	0.169
7.2	0.169
7.4	0.159
7.6	0.15
7.8	0.15
8	0.15
8.2	0.14
8.4	0.14
8.6	0.131
8.8	0.131
9	0.122
9.2	0.122
9.4	0.122
9.6	0.122
9.8	0.112
10	0.112
12	0.103
14	0.084

57M-96-11X Rising Head Test #1



57M-96-11X Rising Head Test #2

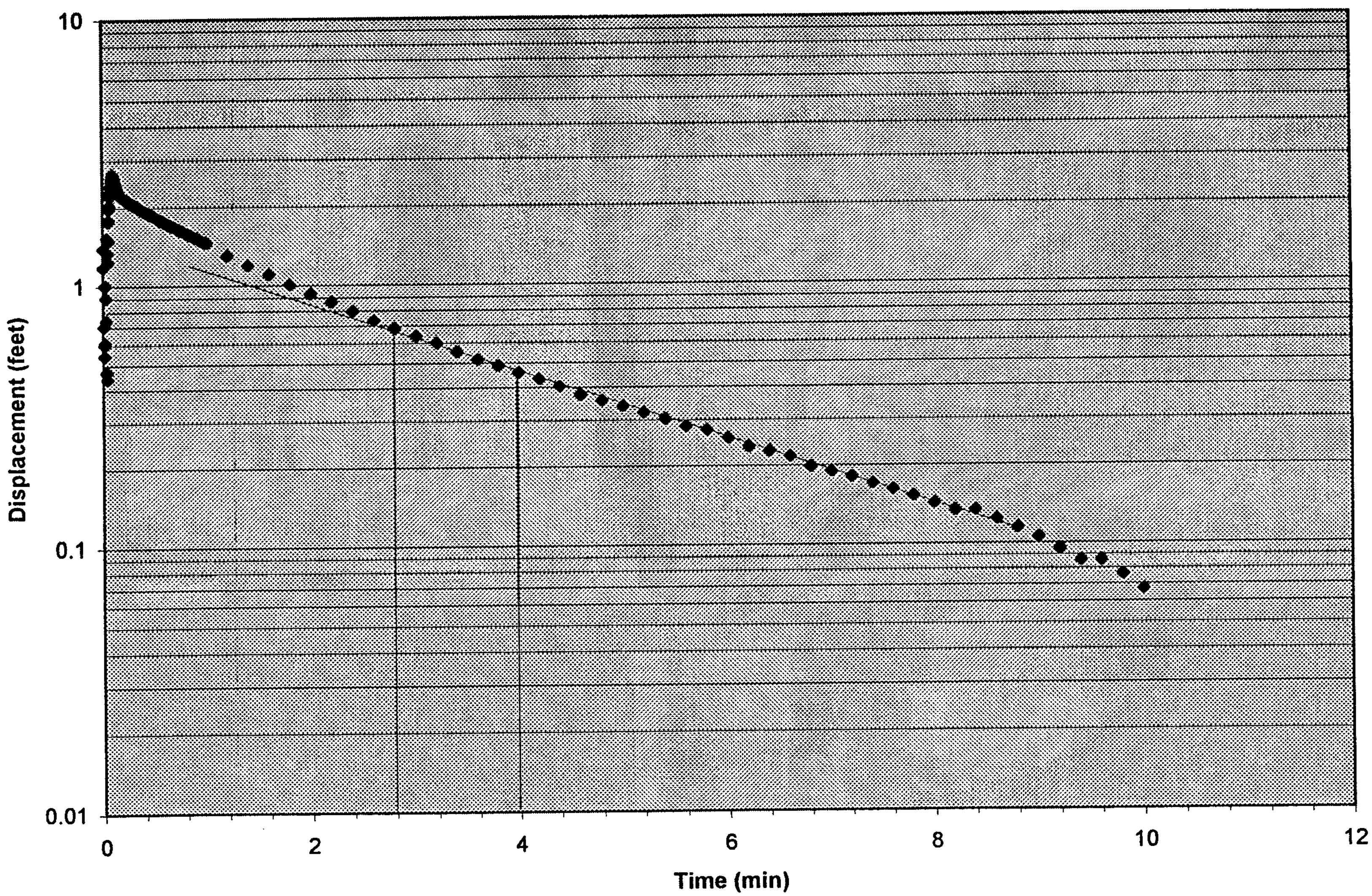
0	0.103	
0.0033	0.863	
0.0066	1.07	
0.01	0.384	
0.0133	0.225	
0.0166	0.281	
0.02	0.291	
0.0233	0.685	
0.0266	0.582	
0.03	0.15	
0.0333	0.422	
0.0366	0.15	
0.04	0.122	
0.0433	1.21	
0.0466	1.023	
0.05	0.919	
0.0533	1.445	
0.0566	1.173	
0.06	1.464	
0.0633	1.661	
0.0666	1.717	
0.07	1.698	
0.0733	1.886	
0.0766	1.971	
0.08	2.065	
0.0833	2.111	
0.0866	2.215	
0.09	2.233	
0.0933	2.29	
0.0966	2.309	
0.1	2.355	max. drawdown = 2.355 - (-0.319) = 2.67 ft.
0.1033	2.327	
0.1066	2.299	
0.11	2.252	
0.1133	2.224	
0.1166	2.187	
0.12	2.158	
0.1233	2.13	
0.1266	2.102	
0.13	2.083	
0.1333	2.055	
0.1366	2.036	
0.14	2.018	
0.1433	1.999	
0.1466	1.98	
0.15	1.971	
0.1533	1.952	
0.1566	1.943	
0.16	1.933	
0.1633	1.924	
0.1666	1.914	

0.17	1.905
0.1733	1.896
0.1766	1.896
0.18	1.886
0.1833	1.877
0.1866	1.877
0.19	1.867
0.1933	1.867
0.1966	1.858
0.2	1.849
0.2033	1.849
0.2066	1.839
0.21	1.839
0.2133	1.83
0.2166	1.83
0.22	1.821
0.2233	1.821
0.2266	1.811
0.23	1.811
0.2333	1.802
0.2366	1.802
0.24	1.792
0.2433	1.792
0.2466	1.792
0.25	1.783
0.2533	1.783
0.2566	1.774
0.26	1.764
0.2633	1.764
0.2666	1.764
0.27	1.755
0.2733	1.755
0.2766	1.755
0.28	1.745
0.2833	1.745
0.2866	1.736
0.29	1.736
0.2933	1.736
0.2966	1.736
0.3	1.727
0.3033	1.727
0.3066	1.727
0.31	1.717
0.3133	1.717
0.3166	1.708
0.32	1.708
0.3233	1.708
0.3266	1.698
0.33	1.698
0.3333	1.698
0.35	1.67

0.3666	1.652
0.3833	1.633
0.4	1.614
0.4166	1.595
0.4333	1.586
0.45	1.567
0.4666	1.548
0.4833	1.539
0.5	1.52
0.5166	1.501
0.5333	1.492
0.55	1.473
0.5666	1.454
0.5833	1.445
0.6	1.426
0.6166	1.417
0.6333	1.398
0.65	1.389
0.6666	1.37
0.6833	1.361
0.7	1.351
0.7166	1.332
0.7333	1.323
0.75	1.304
0.7666	1.295
0.7833	1.286
0.8	1.267
0.8166	1.257
0.8333	1.248
0.85	1.239
0.8666	1.22
0.8833	1.21
0.9	1.201
0.9166	1.192
0.9333	1.173
0.95	1.163
0.9666	1.154
0.9833	1.145
1	1.135
1.2	0.985
1.4	0.872
1.6	0.779
1.8	0.685
2	0.61
2.2	0.544
2.4	0.478
2.6	0.413
2.8	0.366
3	0.319
3.2	0.281
3.4	0.234

3.6	0.197
3.8	0.169
4	0.14
4.2	0.112
4.4	0.084
4.6	0.056
4.8	0.037
5	0.018
5.2	0
5.4	-0.018
5.6	-0.037
5.8	-0.046
6	-0.065
6.2	-0.084
6.4	-0.093
6.6	-0.103
6.8	-0.122
7	-0.131
7.2	-0.14
7.4	-0.15
7.6	-0.159
7.8	-0.168
8	-0.178
8.2	-0.187
8.4	-0.187
8.6	-0.197
8.8	-0.206
9	-0.215
9.2	-0.225
9.4	-0.234
9.6	-0.234
9.8	-0.244
10	-0.253
12	-0.319

57M-96-11X Rising Head Test #2



57M-96-12X Rising Head Test #1

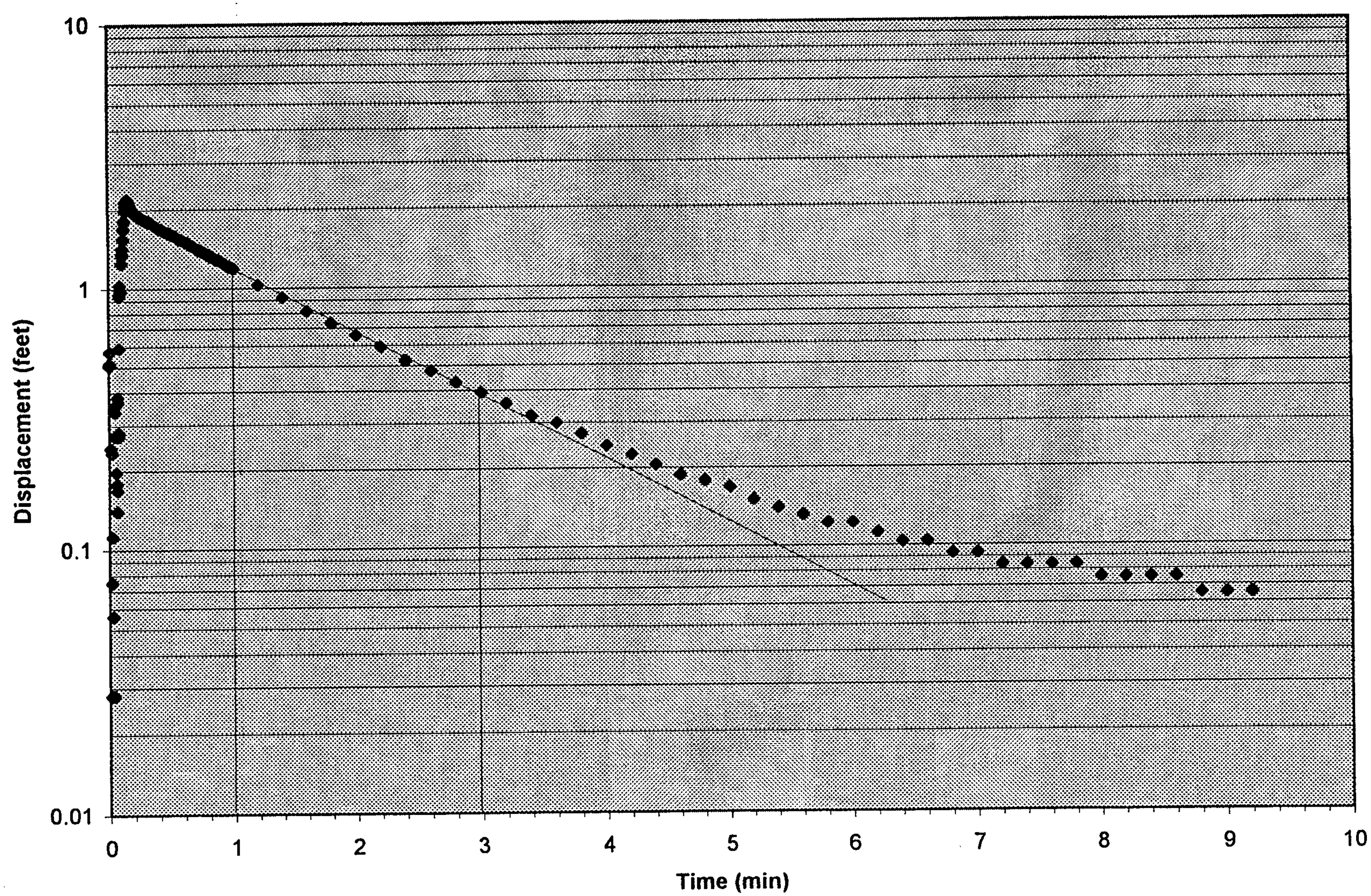
0	0.056
0.0033	0.506
0.0066	0.572
0.01	0.516
0.0133	0.244
0.0166	0.028
0.02	0.075
0.0233	0.234
0.0266	0.112
0.03	0.056
0.0333	0.028
0.0366	-0.056
0.04	-0.084
0.0433	-0.009
0.0466	0.272
0.05	0.337
0.0533	0.356
0.0566	0.197
0.06	0.178
0.0633	0.14
0.0666	0.168
0.07	0.384
0.0733	0.366
0.0766	0.281
0.08	0.272
0.0833	0.591
0.0866	0.938
0.09	0.966
0.0933	1.032
0.0966	0.985
0.1	0.976
0.1033	1.248
0.1066	1.332
0.11	1.351
0.1133	1.417
0.1166	1.539
0.12	1.67
0.1233	1.698
0.1266	1.792
0.13	1.811
0.1333	1.971
0.1366	2.13
0.14	2.046
0.1433	2.14
0.1466	2.168
0.15	2.177
0.1533	2.196 max. drawdown = 2.196 - 0.056 = 2.14 ft.
0.1566	2.158
0.16	2.158
0.1633	2.13
0.1666	2.102

0.17	2.093
0.1733	2.074
0.1766	2.055
0.18	2.036
0.1833	2.027
0.1866	2.008
0.19	1.999
0.1933	1.98
0.1966	1.971
0.2	1.961
0.2033	1.952
0.2066	1.942
0.21	1.933
0.2133	1.924
0.2166	1.924
0.22	1.914
0.2233	1.905
0.2266	1.905
0.23	1.896
0.2333	1.886
0.2366	1.886
0.24	1.886
0.2433	1.877
0.2466	1.877
0.25	1.867
0.2533	1.867
0.2566	1.858
0.26	1.858
0.2633	1.858
0.2666	1.849
0.27	1.849
0.2733	1.839
0.2766	1.839
0.28	1.839
0.2833	1.83
0.2866	1.83
0.29	1.82
0.2933	1.82
0.2966	1.82
0.3	1.811
0.3033	1.811
0.3066	1.811
0.31	1.802
0.3133	1.802
0.3166	1.802
0.32	1.792
0.3233	1.792
0.3266	1.792
0.33	1.783
0.3333	1.783
0.35	1.764

0.3666	1.736
0.3833	1.717
0.4	1.698
0.4166	1.68
0.4333	1.661
0.45	1.651
0.4666	1.633
0.4833	1.623
0.5	1.605
0.5166	1.586
0.5333	1.576
0.55	1.558
0.5666	1.539
0.5833	1.529
0.6	1.511
0.6166	1.492
0.6333	1.483
0.65	1.464
0.6666	1.454
0.6833	1.436
0.7	1.417
0.7166	1.407
0.7333	1.389
0.75	1.379
0.7666	1.37
0.7833	1.351
0.8	1.342
0.8166	1.323
0.8333	1.314
0.85	1.295
0.8666	1.285
0.8833	1.276
0.9	1.267
0.9166	1.248
0.9333	1.238
0.95	1.22
0.9666	1.21
0.9833	1.201
1	1.192
1.2	1.032
1.4	0.919
1.6	0.816
1.8	0.732
2	0.657
2.2	0.591
2.4	0.525
2.6	0.478
2.8	0.431
3	0.394
3.2	0.356
3.4	0.319

3.6	0.3
3.8	0.272
4	0.244
4.2	0.225
4.4	0.206
4.6	0.187
4.8	0.178
5	0.168
5.2	0.15
5.4	0.14
5.6	0.131
5.8	0.122
6	0.122
6.2	0.112
6.4	0.103
6.6	0.103
6.8	0.093
7	0.093
7.2	0.084
7.4	0.084
7.6	0.084
7.8	0.084
8	0.075
8.2	0.075
8.4	0.075
8.6	0.075
8.8	0.065
9	0.065
9.2	0.065

57M-96-12X Rising Head Test #1



57M-96-12X Rising Head Test #2

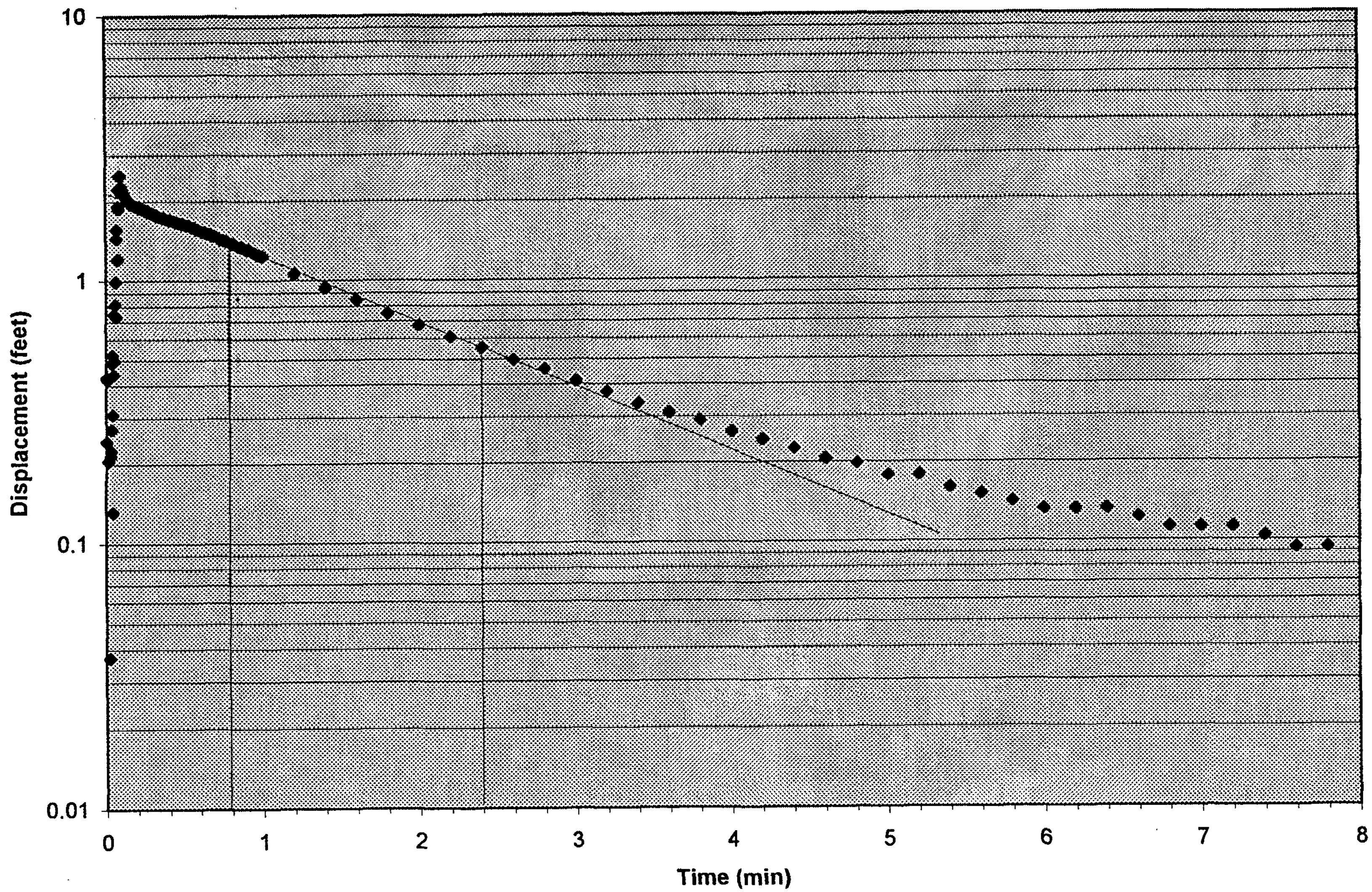
0	0.018
0.0033	0.244
0.0066	0.431
0.01	0.422
0.0133	0.206
0.0166	-0.056
0.02	-0.028
0.0233	0.037
0.0266	0.215
0.03	0.225
0.0333	0.272
0.0366	0.488
0.04	0.525
0.0433	0.309
0.0466	0.131
0.05	0.441
0.0533	0.75
0.0566	0.497
0.06	0.816
0.0633	0.994
0.0666	0.732
0.07	1.436
0.0733	1.558
0.0766	1.201
0.08	1.914
0.0833	2.224
0.0866	1.867
0.09	2.243
0.0933	2.506 max. drawdown = 2.506 - 0.018 = 2.49 ft.
0.0966	2.271
0.1	2.158
0.1033	2.271
0.1066	2.215
0.11	2.14
0.1133	2.177
0.1166	2.158
0.12	2.102
0.1233	2.102
0.1266	2.093
0.13	2.064
0.1333	2.046
0.1366	2.046
0.14	2.018
0.1433	2.008
0.1466	1.999
0.15	1.989
0.1533	1.98
0.1566	1.98
0.16	1.961
0.1633	1.952
0.1666	1.952

0.17	1.942
0.1733	1.942
0.1766	1.942
0.18	1.933
0.1833	1.933
0.1866	1.924
0.19	1.914
0.1933	1.914
0.1966	1.905
0.2	1.905
0.2033	1.905
0.2066	1.905
0.21	1.896
0.2133	1.896
0.2166	1.886
0.22	1.886
0.2233	1.886
0.2266	1.877
0.23	1.877
0.2333	1.867
0.2366	1.867
0.24	1.858
0.2433	1.858
0.2466	1.858
0.25	1.849
0.2533	1.849
0.2566	1.849
0.26	1.839
0.2633	1.83
0.2666	1.839
0.27	1.83
0.2733	1.83
0.2766	1.82
0.28	1.82
0.2833	1.811
0.2866	1.811
0.29	1.811
0.2933	1.792
0.2966	1.792
0.3	1.792
0.3033	1.792
0.3066	1.783
0.31	1.783
0.3133	1.773
0.3166	1.773
0.32	1.773
0.3233	1.764
0.3266	1.764
0.33	1.755
0.3333	1.755
0.35	1.736

0.3666	1.727
0.3833	1.708
0.4	1.698
0.4166	1.689
0.4333	1.68
0.45	1.661
0.4666	1.651
0.4833	1.642
0.5	1.633
0.5166	1.614
0.5333	1.614
0.55	1.586
0.5666	1.576
0.5833	1.558
0.6	1.548
0.6166	1.529
0.6333	1.52
0.65	1.501
0.6666	1.492
0.6833	1.473
0.7	1.464
0.7166	1.445
0.7333	1.426
0.75	1.417
0.7666	1.407
0.7833	1.398
0.8	1.379
0.8166	1.37
0.8333	1.351
0.85	1.332
0.8666	1.332
0.8833	1.314
0.9	1.304
0.9166	1.295
0.9333	1.276
0.95	1.267
0.9666	1.248
0.9833	1.238
1	1.229
1.2	1.06
1.4	0.938
1.6	0.844
1.8	0.75
2	0.675
2.2	0.61
2.4	0.553
2.6	0.497
2.8	0.459
3	0.413
3.2	0.375
3.4	0.337

3.6	0.309
3.8	0.29
4	0.262
4.2	0.244
4.4	0.225
4.6	0.206
4.8	0.197
5	0.178
5.2	0.178
5.4	0.159
5.6	0.15
5.8	0.14
6	0.131
6.2	0.131
6.4	0.131
6.6	0.122
6.8	0.112
7	0.112
7.2	0.112
7.4	0.103
7.6	0.093
7.8	0.093

57M-96-12X Rising Head Test #2



57M-96-13X Rising Head Test #1

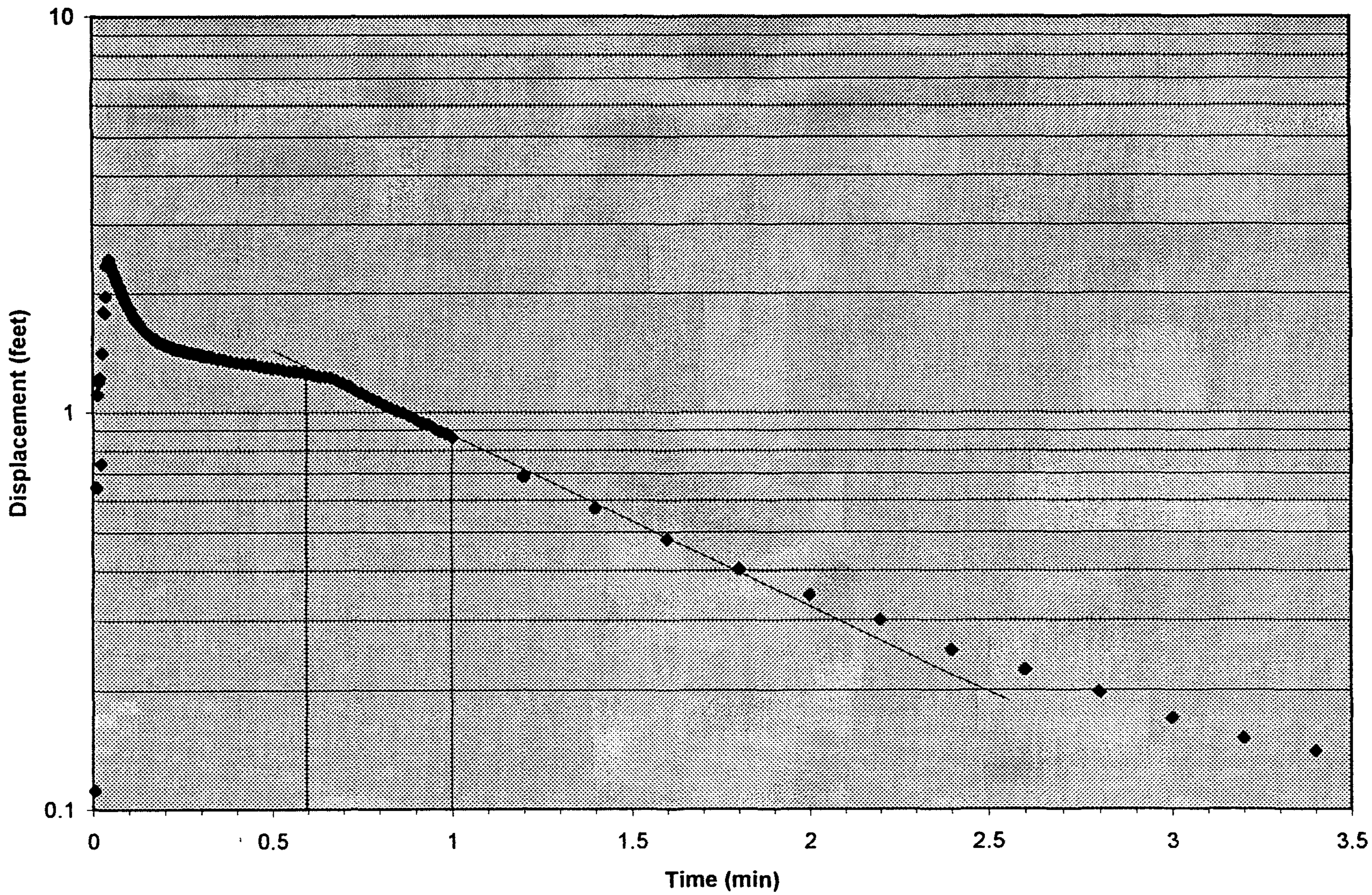
0	0.028
0.0033	0.028
0.0066	0.112
0.01	0.647
0.0133	1.107
0.0166	1.192
0.02	1.22
0.0233	0.741
0.0266	1.407
0.03	1.792
0.0333	1.783
0.0366	1.961
0.04	2.355
0.0433	2.393
0.0466	2.44
0.05	2.365
0.0533	2.327
0.0566	2.28
0.06	2.233
0.0633	2.196
0.0666	2.158
0.07	2.111
0.0733	2.083
0.0766	2.046
0.08	2.008
0.0833	1.971
0.0866	1.942
0.09	1.905
0.0933	1.886
0.0966	1.858
0.1	1.83
0.1033	1.83
0.1066	1.783
0.11	1.764
0.1133	1.745
0.1166	1.727
0.12	1.708
0.1233	1.689
0.1266	1.67
0.13	1.661
0.1333	1.642
0.1366	1.633
0.14	1.614
0.1433	1.605
0.1466	1.595
0.15	1.586
0.1533	1.576
0.1566	1.567
0.16	1.558
0.1633	1.548
0.1666	1.539

max. drawdown = 2.44 - 0.028 = 2.41 ft.

0.17	1.53
0.1733	1.53
0.1766	1.52
0.18	1.511
0.1833	1.501
0.1866	1.501
0.19	1.492
0.1933	1.492
0.1966	1.483
0.2	1.483
0.2033	1.473
0.2066	1.473
0.21	1.464
0.2133	1.464
0.2166	1.464
0.22	1.454
0.2233	1.445
0.2266	1.445
0.23	1.445
0.2333	1.436
0.2366	1.436
0.24	1.436
0.2433	1.436
0.2466	1.426
0.25	1.426
0.2533	1.426
0.2566	1.417
0.26	1.417
0.2633	1.417
0.2666	1.407
0.27	1.407
0.2733	1.407
0.2766	1.407
0.28	1.407
0.2833	1.398
0.2866	1.398
0.29	1.398
0.2933	1.398
0.2966	1.398
0.3	1.389
0.3033	1.389
0.3066	1.389
0.31	1.379
0.3133	1.379
0.3166	1.379
0.32	1.379
0.3233	1.379
0.3266	1.379
0.33	1.379
0.3333	1.37
0.35	1.361

0.3666	1.351
0.3833	1.342
0.4	1.332
0.4166	1.323
0.4333	1.323
0.45	1.314
0.4666	1.304
0.4833	1.295
0.5	1.285
0.5166	1.285
0.5333	1.276
0.55	1.267
0.5666	1.267
0.5833	1.257
0.6	1.248
0.6166	1.239
0.6333	1.229
0.65	1.229
0.6666	1.22
0.6833	1.201
0.7	1.182
0.7166	1.163
0.7333	1.135
0.75	1.117
0.7666	1.098
0.7833	1.079
0.8	1.06
0.8166	1.041
0.8333	1.023
0.85	1.004
0.8666	0.995
0.8833	0.976
0.9	0.957
0.9166	0.938
0.9333	0.929
0.95	0.91
0.9666	0.891
0.9833	0.882
1	0.863
1.2	0.685
1.4	0.572
1.6	0.478
1.8	0.403
2	0.347
2.2	0.3
2.4	0.253
2.6	0.225
2.8	0.197
3	0.169
3.2	0.15
3.4	0.14

57M-96-13X Rising Head Test #1



57M-96-13X Rising Head Test #2

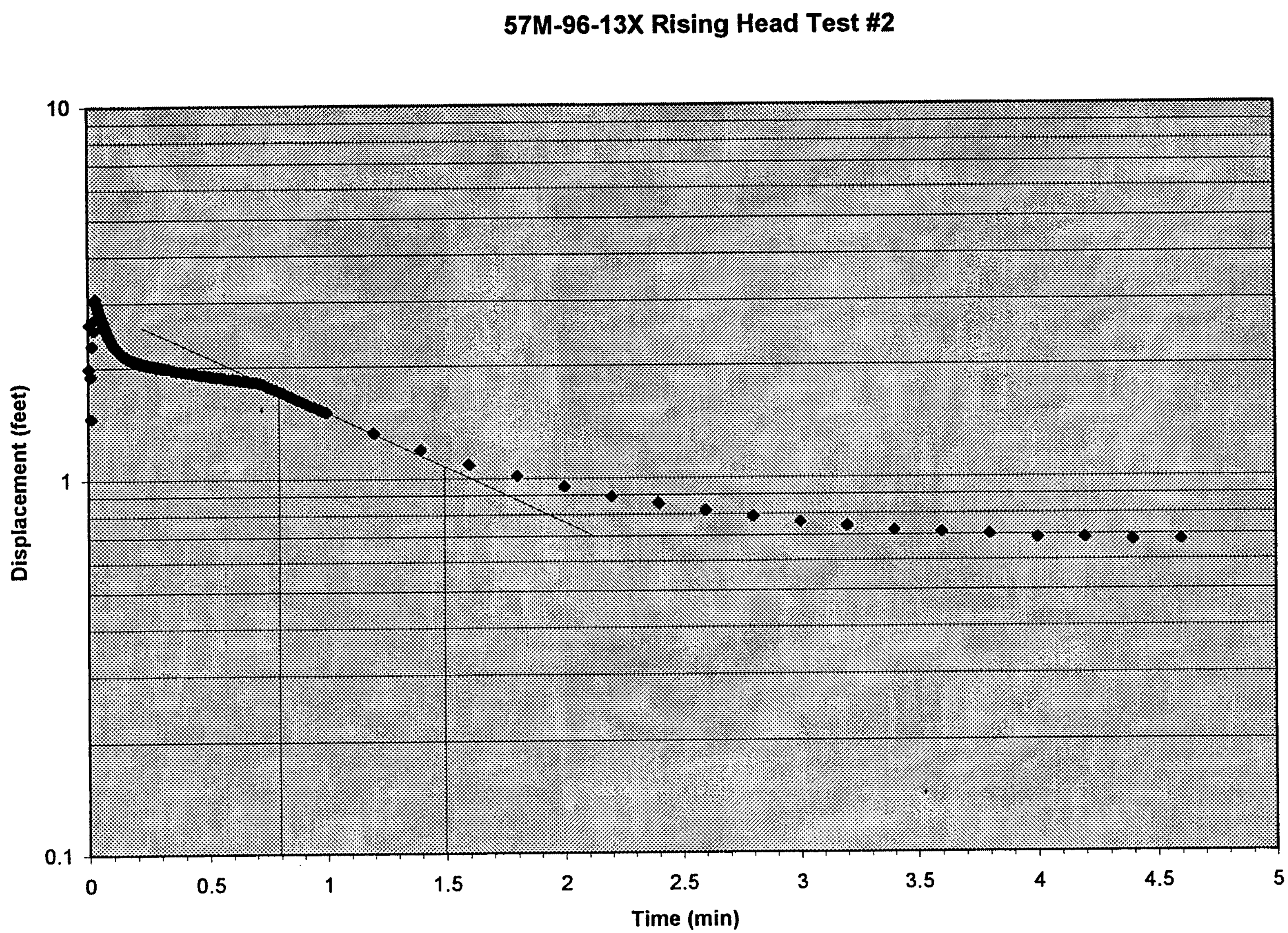
0	0.741
0.0033	1.989
0.0066	2.609
0.01	1.896
0.0133	1.464
0.0166	2.29
0.02	2.675
0.0233	2.524
0.0266	3.022
0.03	3.078
0.0333	3.003
0.0366	2.947
0.04	2.9
0.0433	2.853
0.0466	2.815
0.05	2.778
0.0533	2.74
0.0566	2.693
0.06	2.656
0.0633	2.628
0.0666	2.59
0.07	2.562
0.0733	2.524
0.0766	2.496
0.08	2.468
0.0833	2.44
0.0866	2.412
0.09	2.393
0.0933	2.374
0.0966	2.346
0.1	2.327
0.1033	2.309
0.1066	2.299
0.11	2.28
0.1133	2.262
0.1166	2.252
0.12	2.243
0.1233	2.224
0.1266	2.215
0.13	2.205
0.1333	2.196
0.1366	2.177
0.14	2.177
0.1433	2.158
0.1466	2.158
0.15	2.149
0.1533	2.14
0.1566	2.14
0.16	2.13
0.1633	2.121
0.1666	2.111

max. drawdown = 3.078 - 0.675 = 2.40 ft

0.17	2.111
0.1733	2.102
0.1766	2.102
0.18	2.093
0.1833	2.093
0.1866	2.083
0.19	2.083
0.1933	2.074
0.1966	2.074
0.2	2.064
0.2033	2.074
0.2066	2.064
0.21	2.055
0.2133	2.055
0.2166	2.046
0.22	2.055
0.2233	2.046
0.2266	2.046
0.23	2.046
0.2333	2.036
0.2366	2.036
0.24	2.036
0.2433	2.027
0.2466	2.027
0.25	2.027
0.2533	2.027
0.2566	2.018
0.26	2.018
0.2633	2.018
0.2666	2.018
0.27	2.018
0.2733	2.018
0.2766	2.008
0.28	2.008
0.2833	1.999
0.2866	2.008
0.29	1.999
0.2933	1.999
0.2966	1.999
0.3	1.999
0.3033	1.999
0.3066	1.989
0.31	1.989
0.3133	1.989
0.3166	1.989
0.32	1.989
0.3233	1.98
0.3266	1.98
0.33	1.98
0.3333	1.98
0.35	1.961

0.3666	1.952
0.3833	1.952
0.4	1.942
0.4166	1.933
0.4333	1.924
0.45	1.914
0.4666	1.905
0.4833	1.905
0.5	1.896
0.5166	1.886
0.5333	1.877
0.55	1.877
0.5666	1.867
0.5833	1.858
0.6	1.858
0.6166	1.849
0.6333	1.839
0.65	1.839
0.6666	1.83
0.6833	1.82
0.7	1.82
0.7166	1.811
0.7333	1.792
0.75	1.773
0.7666	1.755
0.7833	1.736
0.8	1.717
0.8166	1.698
0.8333	1.68
0.85	1.661
0.8666	1.642
0.8833	1.623
0.9	1.605
0.9166	1.586
0.9333	1.567
0.95	1.558
0.9666	1.539
0.9833	1.52
1	1.511
1.2	1.323
1.4	1.192
1.6	1.088
1.8	1.013
2	0.947
2.2	0.891
2.4	0.854
2.6	0.816
2.8	0.788
3	0.76
3.2	0.741
3.4	0.722

3.6	0.713
3.8	0.703
4	0.685
4.2	0.685
4.4	0.675
4.6	0.675


57M-96-13X Rising Head Test #2
10
1
0.1
Displacement (feet)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Time (min)

HYDRAULIC GRADIENT AND GROUNDWATER FLOW VELOCITY CALCULATIONS

ESTIMATES OF GROUNDWATER FLOW VELOCITY

$$V = \frac{Ki}{n}$$

NY_
V = Average Linear Velocity
K = Hydraulic Conductivity

L = Horizontal Conductivity
N = Porosity

AREA 2

Maximum Estimate

K = 2.4×10^{-1} ft/min = 345.6 feet/day
i = 0.0127 ft/ft maximum mean (July 23, 1996)
n = 0.3

$$V = \frac{(345.6 \text{ ft/day})\ (0.0127\text{ft/ft})}{0.3} = 14 \text{ feet/day}$$

Minimum Estimate

K = 8.3×10^{-4} ft/min = 1.19 ft/day (Bouwer and Rice Method 57m.95.08A)
i = 0.0095 Minimum Mean (Dec. 7, 1995)
n = 0.3

$$V = \frac{(1.19 \text{ ft/day})(0.0095 \text{ ft/ft})}{0.3} = 0.038 \text{ ft/day}$$

Mean

$K = 3.24 \times 10^{-2}$ ft/min = 46.7 ft/day
i = 0.01 ft/ft
n = 0.3

$$V = \frac{(46.7)\ (0.01 ft/ft)}{0.3} = 1.56\ ft/day$$

AREA 3

Minimum Estimate

$K = 1.36 \times 10^{-3}$ ft/min = 1.96 ft/day (as determined by Bouwer & Rice at 57m.96.10X)
i = 0.022 ft/ft mean of Jean. 15 gradients
n = 0.3

$$V = \frac{(1.96\ ft/day)\ (0.022)}{0.3} = 0.14\ ft/day$$

Maximum Estimate

$K = 1.1 \times 10^{-2}$ ft/min = 15.84 feet/day (as determined by Bouwer & Rich at 57m.95.03x)
i = 0.022 ft/ft
n = 0.3

$$V = \frac{(15.84\ ft/day)\ (0.022\ ft/ft)}{0.3} = 1.16\ feet/day$$

<u>Mean</u>

$K = 3.54 \times 10^{-3}$ ft/min = 5.1 ft/day
$i = 0.022$ ft/ft
$n = 0.3$

$$V = \frac{(5.1 \text{ ft/day})\ (0.022)}{0.3} = 0.37 \text{ ft/day}$$

HYDRAULIC GRADIENT CALCULATIONS
AOC 57 AREA 2

Distance between wells		December 7, 1995 Water Elevation (msl)	δh	/	Dist	=	Horizontal Gradient i	
G3M-92-02X		224.72						
	456 ft		2.75	/	456	=	**0.006**	
57M-95-05X		221.97						
57M-95-06X		223						
	118 ft		1.81	/	118	=	**0.015**	
57M-95-08A		221.19						
G3M-92-02X		224.72						
	564 ft		5.22	/	564	=	**0.009**	
57P-95-01A		219.5						

Average	**0.010**
Geo. Mean	**0.009**
Median	**0.009**

Vertical Gradients

Wells	Distance	Water Elevation (msl)	δh	/	Dist	=	i	Direction
57P-95-01A		219.5						
	9 ft*		0.25	/	9	=	**0.028**	**upward**
57P-95-01B		219.75						
57M-95-04A		220.82						
	16.4 ft*		0.01		16.4		**0.001**	**upward**
57M-95-04B		220.83						
57M-95-08A		221.19						
	15.5 ft*		0.18		15.5		**0.012**	**downward**
57M-95-08B		221.01						

Notes:
* : Distance seperating middle of well screens
msl mean sea level

HYDRAULIC GRADIENT CALCULATIONS
AOC 57 AREA 2

Distance between wells		March 26, 1996 Water Elevation (msl)	δh	/	Dist	=	Horizontal Gradient i	
G3M-92-02X		225.5						
	456 ft		3.08	/	456	=	**0.007**	
57M-95-05X		222.42						
57M-95-06X		223.75						
	118 ft		2.28	/	118	=	**0.019**	
57M-95-08A		221.47						
G3M-92-02X		225.5						
	564 ft		4.85	/	564	=	**0.009**	
57P-95-01A		220.65						
					Average		**0.012**	
					Geo. Mean		**0.010**	
					Median		**0.009**	
Vertical Gradients								
57P-95-01A		220.65						
	9 ft*		0.28	/	9	=	**0.031**	**upward**
57P-95-01B		220.93						
57M-95-04A		221.11						
	16.4 ft*		0.02	/	16.4	=	**0.001**	**upward**
57M-95-04B		221.13						
57M-95-08A		221.47						
	15.5 ft*		0.11	/	15.5	=	**0.007**	**downward**
57M-95-08B		221.36						

Notes:
* : Distance seperating middle of well screens
msl mean sea level

HYDRAULIC GRADIENT CALCULATIONS
AOC 57 AREA 2

Distance between wells		July 23, 1996 Water Elevation (msl)	δh	/	Dist	=	Horizontal Gradient i	
G3M-92-02X		226.19						
	456 ft		4.65	/	456	=	0.010	
57M-95-05X		221.54						
57M-95-06X		223.84						
	118 ft		2.39	/	118	=	0.020	
57M-95-08A		221.45						
G3M-92-02X		226.19						
	564 ft		5.56	/	564	=	0.010	
57P-95-01A		220.63						
					Average		0.013	
					Geo. Mean		0.013	
					Median		0.010	
Vertical Gradients								
57P-95-01A		220.63						
	9 ft*		0.29	/	9	=	0.032	upward
57P-95-01B		220.92						
57M-95-04A		221.08						
	16.4 ft*		0.01	/	16.4	=	0.001	upward
57M-95-04B		221.09						
57M-95-08A		221.45						
	15.5 ft*		0.1	/	15.5	=	0.006	downward
57M-95-08B		221.35						

Notes:
* : Distance seperating middle of well screens
msl mean sea level

HYDRAULIC GRADIENT CALCULATIONS
AOC 57 AREA 2

Distance between wells		January 15,1997 Water Elevation (msl)	δh	/	Dist	=	Horizontal Gradient i	
G3M-92-02X		226.71						
	456 ft		3.89	/	456	=	**0.009**	
57M-95-05X		222.82						
57M-95-06X		224.15						
	118 ft		2.48	/	118	=	**0.021**	
57M-95-08A		221.67						
G3M-92-02X		226.71						
	564 ft		6	/	564	=	**0.011**	
57P-95-01A		220.71						
					Average		**0.013**	
					Geo. Mean		**0.012**	
					Median		**0.011**	
Vertical Gradients								
57P-95-01A		220.71						
	9 ft*		0.35	/	9	=	**0.039**	**upward**
57P-95-01B		221.06						
57M-95-04A		221.25						
	16.4 ft*		0.02	/	16.4	=	**0.001**	**upward**
57M-95-04B		221.27						
57M-95-08A		221.67						
	15.5 ft*		0.1	/	15.5	=	**0.006**	**downward**
57M-95-08B		221.57						

Notes:
* : Distance seperating middle of well screens
msl mean sea level

HYDRAULIC GRADIENT CALCULATIONS
AOC 57 AREA 3

Distance between wells		January 15,1997 Water Elevation (msl)	δh	/	Dist	=	Horizontal Gradient i
57M-96-09X		225.97					
	226 ft		4.88	/	226	=	**0.022**
57M-96-11X		221.09					
57M-96-09X		225.97					
	180 ft		2.49	/	180	=	**0.014**
57M-96-12X		223.48					
57M-95-03X		224.88					
	105 ft		3.79	/	105	=	**0.036**
57M-96-11X		221.09					

Average	**0.024**
Geo. Mean	**0.022**
Median	**0.022**

Notes: msl mean sea level

HYDRAULIC GRADIENT CALCULATIONS
AOC 57 AREA 2

			June 2, 1997					Horizontal	
Distance between wells			Water Levels					Gradient	
				δh	/	Dist	=	i	
G3M-92-02X			226.79						
	456	ft		3.99	/	456	=	0.00875	
57M-95-05X			222.8						
57M-95-06X			224.04						
	118	ft		2.46	/	118	=	0.020847	
57M-95-08A			221.58						
G3M-92-02X			226.79						
	564	ft		6.09	/	564	=	0.010798	
57P-95-01A			220.7						
						Average		0.013465	
Vertical Gradients						Geo. Mean		0.012535	
						Median		0.010798	
57P-95-01A			220.7						
	9	ft*		0.34	/	9	=	0.037778	upward
57P-95-01B			221.04						
57M-95-04A			221.25						
	16.4	ft*		0.04	/	16.4	=	0.002439	upward
57M-95-04B			221.29						
57M-95-08A			221.58						
	15.5	ft*		0.03	/	15.5	=	0.001935	downward
57M-95-08B			221.55						
Notes:	*	:	Distance seperating middle of well screens						

HYDRAULIC GRADIENT CALCULATIONS
AOC 57 AREA 3

			June 2, 1997						Horizontal
Distance between wells			Water Levels						Gradient
					δh	/	Dist	=	i
57M-96-09X			225.82						
	226	ft			4.81	/	226	=	0.021283
57M-96-11X			221.01						
57M-96-09X			225.82						
	180	ft			2.42	/	180	=	0.013444
57M-96-12X			223.4						
57M-95-03X			224.55						
	105	ft			3.54	/	105	=	0.033714
57M-96-11X			221.01						
							Average		0.022814
							Geo. Mean		0.021288
							Median		0.021283

HYDRAULIC GRADIENT CALCULATIONS
AOC 57 AREA 2

Distance between wells			September 23, 1998 Water Levels	δh	/	Dist	=	Horizontal Gradient i	
G3M-92-02X			225.74						
	456	ft		3.2	/	456	=	0.007018	
57M-95-05X			222.54						
57M-95-06X			223.5						
	118	ft		1.85	/	118	=	0.015678	
57M-95-08A			221.65						
G3M-92-02X			225.74						
	564	ft		5.07	/	564	=	0.008989	
57P-95-01A			220.67						
						Average		0.010562	
Vertical Gradients						Geo. Mean		0.009963	
						Median		0.008989	
57P-95-01A			220.67						
	9	ft*		0.28	/	9	=	0.031111	upward
57P-95-01B			220.95						
57M-95-04A			221.19						
	16.4	ft*		0.01	/	16.4	=	0.00061	downward
57M-95-04B			221.18						
57M-95-08A			221.65						
	15.5	ft*		0.3	/	15.5	=	0.019355	downward
57M-95-08B			221.35						

Notes: * : Distance seperating middle of well screens

HYDRAULIC GRADIENT CALCULATIONS
AOC 57 AREA 3

Distance between wells		September 23, 1998 Water Levels					Horizontal Gradient
			δh	/	Dist	=	i
57M-96-09X		224.54					
	226 ft		3.32	/	226	=	0.01469
57M-96-11X		221.22					
57M-96-09X		224.54					
	180 ft		1.48	/	180	=	0.008222
57M-96-12X		223.06					
57M-95-03X		224.31					
	105 ft		3.09	/	105	=	0.029429
57M-96-11X		221.22					
					Average		0.017447
					Geo. Mean		0.015261
					Median		0.01469

WELL DEVELOPMENT RECORDS

WELL DEVELOPMENT RECORD

Project: Ft. Devens

Well Installation Date: ~~10~~ 09/22/95

Project No. 09144-02

Client: USAEC

Well Development Date: 10/4/95

Developed by: M. Lounsbury

Checked by: --

Well/Site I.D.: 57M-95-01Y

Weather: Rain, 65°

Start Date: 10/4/95

Finish Date: 10/4/95

Well Construction Record Data:

Bottom of Screen 29 ft.

Sediment Sump/Plug N/A ft.

Screen Length 10 ft.

From Ground Surface ☒ From top of Riser ☐

Well Diameter 4 in.

Start Time: 1100

Finish Time: 12

Fluids Lost During Drilling N/A gal.

Protective Casing Stick-up 2.10 ft.

Protective Casing/Well Diff. -0.30 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial 24.61 ft.

End of Development 24.62 ft.

24 Hrs. After Development ~~ft.~~ Not measured

HT of Water Column 6.2 ft. x ☐ 1.68* ☐ ____ = 10 gal./vol.

*For 4" HSA installed wells

Sediment:

Well Depth Before Development 30.81 ft. (from top of PVC)

Well Depth After Development 30.81 ft.

Sediment Depth Removed 0 ft.

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ______
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 1 gpm

Total Gallons Removed 55 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☒	☐
• Sediment thickness remaing in well is <1.0% of screen length	☒	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☒	☐

Notes: well recharges fine

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
1100	1	1	5.26	13.0	.254	over	1 gpm
	2	10	5.22	13.1	.111	110	"
	3	20	5.03	13.1	.119	21	"
	4	30	5.05	13.1	.129	22	"
	5	40	5.07	13.0	.121	90	"

Well Developer's Signature ____________

ABB Environmental Services, Inc.

9312005S L6

WELL DEVELOPMENT RECORD

Project: Ft. Devens	Well Installation Date: 09/29/95	Project No. 09144-02
Client: USAEC	Well Development Date: 10/4/95	Developed by: M. [illegible] / Checked by: -
Well/Site I.D.: 57M-95-02X	Weather: Rain 60°	Start Date: 10/4/95 / Finish Date: 10/4/95

Well Construction Record Data:

- Bottom of Screen: 24 ft.
- Sediment Sump/Plug: N/A ft.
- Screen Length: 10 ft.

From Ground Surface ☒ From top of Riser ☐

Well Diameter: 4 in.

Start Time: 825 — Finish Time: 930

Fluids Lost During Drilling: 0 gal.

Protective Casing Stick-up: 2.80 ft. Protective Casing/Well Diff.: -0.50 ft.

PID Readings: Ambient Air — ppm; Well Mouth — ppm

Water Levels:

- Initial: 19.09 ft.
- End of Development: 19.19 ft.
- 24 Hrs. After Development: 19.01 ft.

Sediment:

- Well Depth Before Development: 27.0 ft. (from top of PVC)
- Well Depth After Development: 27.0 ft.
- Sediment Depth Removed: 0 ft.

HT of Water Column: 8 ft. x ☐ 1.68* ☐ ____ = 13 gal./vol. *For 4" HSA installed wells

Equipment:

- ☒ Dedicated Submersible Pump
- ☐ Surge Block
- ☐ Bailer ☐ 2" ☐ ____
- ☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: ____ gpm

Total Gallons Removed: ____ gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☒	☐
• Sediment thickness remaing in well is <1.0% of screen length	☒	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☒	☐

Notes: ~~for~~ well recharges good, pump was on bottom.

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
825	1	1	5.78	13.5	.381	over	1 GPM
	2	13	6.21	13.9	.289	133	"
	3	26	5.83	13.8	.271	15	"
	4	39	5.84	13.5	.285	—	"
	5	52	5.80	13.8	.291	—	

turb. not Done

Well Developer's Signature [signature]

ABB Environmental Services, Inc.

9312005S L6

WELL DEVELOPMENT RECORD

Project: Ft. Devens	Well Installation Date: 10/3/95		Project No. 09144.02
Client: USAEC	Well Development Date: 10/5/95	Developed by: M. Lounsbury	Checked by:
Well/Site I.D.: 57M-95-03X	Weather: Cloudy, 60°	Start Date: 10/5/95	Finish Date: 10/6/95

Well Construction Record Data:

Bottom of Screen 17 ft. — From Ground Surface ☑ From top of Riser ☐

Sediment Sump/Plug N/A ft.

Screen Length 10 ft.

Well Diameter 4 in.

Start Time: 1150 Finish Time: 1030

Fluids Lost During Drilling N/A gal.

Protective Casing Stick-up 3.0 ft. Protective Casing/Well Diff. -0.36 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels: 10/4/95 10/5/95 10/6

Initial 13.09 ft. 13.19 13.37 13.33

End of Development 18.67 ft. 10/6/95 11.75

24 Hrs. After Development ~~8~~ ft.

HT of Water Column 5.43 ft. x ☐ 1.68* ☐ ____ = 12 gal./vol.

*For 4" HSA installed wells

Sediment:

Well Depth Before Development 18.52 ft. (from top of PVC)

Well Depth After Development 18.67 ft.

Sediment Depth Removed .10 ft.

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ______
☐ Grundfos Pump 2" ___ 4" ___

Approximate Recharge Rate 1/2 gpm

Total Gallons Removed 50 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☒	☐
• Sediment thickness remaing in well is <1.0% of screen length	☒	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☒	☐

Notes: recharge rate ≈ 1/2 gpm - Sweet odor on purge water - purge water containerized because of odor.

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

	Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
10/5/95	1110	1	1	6.31	12.8	.188	over	1 GPM
	1208	2	10	5.85	12.7	.166	over	"
	1300	3	20	5.81	12.8	.170	186	"
10/6/95	811	4	30	5.56	12.6	.232	37	"
	915	5	40	5.73	12.7	.203	21	"
	1030	6	50	5.65	12.7	.195	22	"

Well Developer's Signature [signature]

9312005S L 6 — ABB Environmental Services, Inc.

WELL DEVELOPMENT RECORD

Project: Ft. Devens	Well Installation Date: 10/4/95		Project No. 09144-02
Client: USAEC	Well Development Date: 10/10/95	Developed by: M. Lounsbury	Checked by:
Well/Site I.D.: 57M-9504A	Weather: Sunny 60°	Start Date: 10/10/95	Finish Date: 10/10/95
		Start Time: 930	Finish Time: 1045

Well Construction Record Data:

Bottom of Screen 12.4 ft. — From Ground Surface ☒ From top of Riser ☐

Sediment Sump/Plug N/A ft.

Screen Length 10 ft.

Well Diameter 4 in.

Fluids Lost During Drilling ~ gal.

Protective Casing Stick-up 1.35 ft. Protective Casing/Well Diff. -0.4 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial	3.27 ft.
End of Development	3.31 ft.
24 Hrs. After Development	3.25 ft.

Sediment:

Well Depth Before Development	12.82 ft. (from top of PVC)
Well Depth After Development	12.86 ft.
Sediment Depth Removed	.04 ft.

HT of Water Column 10 ft. x ☐ 1.68* ☐ ____ = 16 gal./vol. *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"____ 4"____

Approximate Recharge Rate 1(+) gpm

Total Gallons Removed 90 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☒	☐
• Sediment thickness remaing in well is <1.0% of screen length	☒	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☒	☐

Notes: Well Containerized Due to Contaminated Soil Found In Hole

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
930	1	1	5.65	12.7	.278	Over	1(+) GPM
			5.67	13.5	.123	742	"
			5.41	13.1	.114	90	"
			5.31	13.6	.093	98	"
			5.20	13.6	.087	18	"
1035			5.19	13.7	.088	13	

Well Developer's Signature [signature]

ABB Environmental Services, Inc.

WELL DEVELOPMENT RECORD

Project: Ft. Devens	Well Installation Date: 10/3/95 (GJM)		Project No. 9144.02 (GJM)
Client: USAEC (GJM)	Well Development Date: 10/10/95	Developed by: M. Lounsbury	Checked by:
Well/Site I.D.: 57M-95~~06~~04B	Weather: Sunny 65°	Start Date: 10/10/95	Finish Date: 10/10/95

Well Construction Record Data:

Bottom of Screen 28.51 ft. (GJM) — From Ground Surface ☒ From top of Riser ☐

Sediment Sump/Plug ~~28.91~~ ft. N/A (GJM)

Screen Length 10 ft.

Well Diameter 4 in.

Fluids Lost During Drilling – gal.

Start Time: 1150 Finish Time: 1330 (GJM)

Protective Casing Stick-up 2.44 ft. Protective Casing/Well Diff. -0.16 ft.

PID Readings: Ambient Air 0 ppm Well Mouth 0 ppm

Water Levels:

- Initial 4.09 ft.
- End of Development 4.09 ft.
- 24 Hrs. After Development 4.10 ft.

Sediment:

- Well Depth Before Development 31.20 ft. (from top of PVC)
- Well Depth After Development 31.25 ft.
- Sediment Depth Removed .05 ft.

HT of Water Column 27 ft. x ☒ 1.68* ☐ ____ = 70 gal./vol. *For 4" HSA installed wells

Equipment:

- ☒ Dedicated Submersible Pump
- ☐ Surge Block
- ☐ Bailer ☐ 2" ☐ ______
- ☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 1T gpm

Total Gallons Removed 200 gal.

Well Development Criteria Met:

Notes: Well recharges extremely well

	yes	no
• Well water clear to unaided eye	☒	☐
• Sediment thickness remaing in well is <1.0% of screen length	☒	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☒	☐

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
1150	1	1	5.63	12.9	.231	860	2 GPM
	2	40	5.59	12.5	.235	43	"
	3	80	5.41	12.1	.236	1	"
	4	120	5.42	12.4	.233	8	"
	5	160	5.44	12.4	.237	0	"
1330	6	200	5.44	12.4	.235	0	"

Well Developer's Signature [signature]

ABB Environmental Services, Inc.

9312005S L6

WELL DEVELOPMENT RECORD

Project: Ft. Devens	Well Installation Date: 10/3/95 GM		Project No. 09144-02
Client: USAEC GM	Well Development Date: 10/10/95	Developed by: M. Lounsbury	Checked by:
Well/Site I.D.: 57M-95-05X	Weather: Sunny - 65°	Start Date: 10/10/95	Finish Date: 10/10/95

Well Construction Record Data:

Bottom of Screen 20 ft.
Sediment Sump/Plug N/A ft. GM
Screen Length 10 ft.
—From Ground Surface ☒ From top of Riser ☐

Well Diameter 4 in.
Start Time: 1510 Finish Time: 1610
Fluids Lost During Drilling — gal.

Protective Casing Stick-up 3.10 ft. Protective Casing/Well Diff. -0.50 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:
Initial 15.70 ft.
End of Development 15.79 ft.
24 Hrs. After Development 15.70 ft.

Sediment:
Well Depth Before Development 22.45 ft.
Well Depth After Development 22.64 ft.
Sediment Depth Removed 0.19 ft.
(from top of PVC)

HT of Water Column 6 ft. x ☐ 1.68* ☐ ____ = gal./vol. 10 GM
*For 4" HSA installed wells

Equipment:
☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2" ____ 4" ____

Approximate Recharge Rate 1+ gpm
Total Gallons Removed 60 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☒	☐
• Sediment thickness remaing in well is <1.0% of screen length	☒	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☒	☐

Notes: Very Little Sand/Silt in well

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
1510	1	1	9.40	14.6	.298	Over	10 GPM
	2	10	8.05	14.7	.127	28	"
	3	20	6.81	14.4	.135	10	"
	4	30	6.24	14.4	.121	1	"
	5	40	5.87	14.4	.117	24	"
1610	6	50	5.66	14.5	.117	0	"

Well Developer's Signature [signature]

ABB Environmental Services, Inc.

9312005S L 6

WELL DEVELOPMENT RECORD

Project: Ft. Devens	Well Installation Date: 10/4/95		Project No. [illegible]
Client: USAEC	Well Development Date: 10/11/95	Developed by: R. Lounsbury	Checked by:
Well/Site I.D.: 57M-95-06X	Weather: Sunny 65°	Start Date: 10/11/95	Finish Date: 10/11/95

Well Construction Record Data:

Bottom of Screen 21.87 ft. — From Ground Surface ☐ From top of Riser ☐

Sediment Sump/Plug ~~22.04~~ ft. N/A

Screen Length 10 ft.

Well Diameter 4 in.

Start Time: 740 Finish Time: 855

Fluids Lost During Drilling — gal.

Protective Casing Stick-up 2.13 ft. Protective Casing/Well Diff. -0.16 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial 14.03 ft.

End of Development 15.15 ft.

24 Hrs. After Development 14.05 ft.

24.55
23.82
.73

Sediment:

Well Depth Before Development 23.82 ft. (from top of PVC)

Well Depth After Development 24.55 ft.

Sediment Depth Removed 0.73 ft.

HT of Water Column 10 ft. x ☐ 1.68* ☐ ____ = 16 gal./vol. *For 4" HSA installed wells

Equipment:

- ☒ Dedicated Submersible Pump
- ☐ Surge Block
- ☐ Bailer ☐ 2" ☐ ______
- ☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 1.5 gpm

Total Gallons Removed 80 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☒	☐
• Sediment thickness remaing in well is <1.0% of screen length	☒	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☒	☐

Notes: Well recharged very well

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
740	1	1	5.42	12.9	.153	—	1.5 gpm
813	2	15	5.35	13.3	.109	over	4
825	3	30	5.50	13.6	.106	60	4
833	4	45	5.41	13.8	.104	0	4
842	5	60	5.46	13.5	.104	0	4

* turb meter not working properly

850	6	75	5.41	13.5	.104	0	4

Well Developer's Signature [signature]

ABB Environmental Services, Inc.

9312005S L6

WELL DEVELOPMENT RECORD

Project: Ft. Devens

Well Installation Date: 10/5/95

Project No. 09144.02

Client: USAEC

Well Development Date: 10/12/95

Developed by: M. Lounsbury

Checked by:

Well/Site I.D.: 57m-95-07x

Weather: Sunny 60°

Start Date: 10/12/95

Finish Date: 10/12/95

Well Construction Record Data:

Well Diameter 4 in.

Start Time: 745

Finish Time: 855

Bottom of Screen 13 ft.

Sediment Sump/Plug N/A ft.

Screen Length 10 ft.

From Ground Surface ☒ From top of Riser ☐

Fluids Lost During Drilling — gal.

Protective Casing Stick-up 1.55 ft. Protective Casing/Well Diff. ~0.33 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial 3.68 ft.

End of Development 3.70 ft.

24 Hrs. After Development 3.71 ft.

Sediment:

Well Depth Before Development 14.33 ft. (from top of PVC)

Well Depth After Development 14.43 ft.

Sediment Depth Removed .10 ft.

HT of Water Column 10 ft. x ☐ 1.68* ☐ ____ = 16 gal./vol. *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 1.5 gpm

Total Gallons Removed 90 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☒	☐
• Sediment thickness remaing in well is <1.0% of screen length	☒	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☒	☐

Notes:

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
745	1	1	5.24	12.4	.161	over	1.5 GPM
	2	16	5.06	12.9	.159	200	"
	3	32	5.16	12.7	.153	0	"
	4	48	5.20	13.0	.150	0	"
	5	64	5.24	12.9	.156	0	"
848	6	80	5.25	11.8	.151	0	"

Well Developer's Signature [signature]

ABB Environmental Services, Inc.

9312005S L6

WELL DEVELOPMENT RECORD

Project: Ft. Devens	Well Installation Date: 10/10/95		Project No. 09144-02
Client: USAEC	Well Development Date: 10/13/95	Developed by: R. Lounsbury	Checked by:
Well/Site I.D.: 57M-95-08A	Weather: Sunny 70°	Start Date: 10/13/95	Finish Date: 10/13/95
		Start Time: 920	Finish Time: 1215

Well Construction Record Data:

Bottom of Screen 13 ft. — From Ground Surface ☒ From top of Riser ☐

Sediment Sump/Plug N/A ft.

Screen Length 10 ft.

Well Diameter 4 in.

Fluids Lost During Drilling — gal.

Protective Casing Stick-up 1.65 ft. Protective Casing/Well Diff. -0.23 ft.

PID Readings: Ambient Air — ppm; Well Mouth — ppm

Water Levels:

Initial 3.17 ft.

End of Development 12.57 ft.

24 Hrs. After Development 3.14 ft. (10/16)

Sediment:

Well Depth Before Development 13.35 ft. (from top of PVC)

Well Depth After Development 14.30 ft.

Sediment Depth Removed 0.95 ft.

HT of Water Column 10 ft. x ☐ 1.68* ☐ ____ = 16 gal./vol. *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 1/2 gpm

Total Gallons Removed gal.

Well Development Criteria Met:

	yes	no
Well water clear to unaided eye	☒	☐
Sediment thickness remaing in well is <1.0% of screen length	☐	☐
Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☐	☐

Notes: * Battery Died after 1st Volume, had to recharge before Continuing development

End of Well Development Sample (1 pint) Collected? yes ☐ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
920	1	1	5.72	12.6	.102	over	1 GPM
935	2	16	5.80	13.0	.100	158	—
1030	3	32	6.13	14.0	.097	101	—
1052	4	48	5.89	13.7	.088	0	—
1110	5th	54	5.80	13.6	.083	0	—
1215	6th	80	6.05	15.1	.084	0	—

* Battery Very Low pump 1-1/2 gpm well will run dry when purging with Fully Charged battery. There Still might be a little Sed Left In well.

Well Developer's Signature [signature]

9312005S L6 — ABB Environmental Services, Inc.

WELL DEVELOPMENT RECORD

Project: Ft. Devens	Well Installation Date: 10/10/95 GM		Project No. 07144402
Client: USAEC GM	Well Development Date: 10/12/95	Developed by: M. Lounsbury	Checked by:
Well/Site I.D.: 57M-95-08B	Weather: Sunny 70°	Start Date: 10/12/95	Finish Date: 10/13/95
		Start Time: 1358	Finish Time: 855

Well Construction Record Data:

Bottom of Screen ~~28~~ 39 ~~13~~ ft. GM
Sediment Sump/Plug N/A ft.
Screen Length 10 ft.
— From Ground Surface ☒ From top of Riser ☐ GM

Well Diameter 4 in.

Fluids Lost During Drilling — gal.

Protective Casing Stick-up 2.85 ft. Protective Casing/Well Diff. -0.49 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:
- Initial 4.00 ft.
- End of Development 4.32 ft.
- 24 Hrs. After Development 3.93 ft.

Sediment:
- Well Depth Before Development 30.24 ft. (from top of PVC)
- Well Depth After Development 30.32 ft.
- Sediment Depth Removed 0.18 ft.

HT of Water Column 26 ft. x ☐ 1.68* ☐ ____ = 44 gal./vol. *For 4" HSA installed wells

Equipment:
- ☒ Dedicated Submersible Pump GM
- ☐ Surge Block
- ☐ Bailer ☐ 2" ☐ ______
- ☐ Grundfos Pump 2" ___ 4" ___

Approximate Recharge Rate 25 gpm
Total Gallons Removed 200 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☒	☐
• Sediment thickness remaing in well is <1.0% of screen length	☒	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☒	☐

Notes: purged 90 gals on 10/12/95 - Battery ran dead at 1700. Finished Development on 10/13/95

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐ GM

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

	Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	Pumping Rate
10/12/95	1358	1	1	7.52	13.4	.216	over	1.5 GPM
	1630	2	44	6.58	12.3	.236	12	—
	1700	3	88	5.70	13.1	.233	17	—
10/13/95	755	4	132	4.53	11.8	.283	0	—
	825	5	176	5.68	11.6	.251	6	—
	855	6	220	5.31	11.4	.240	0	—

Well Developer's Signature [signature]

ABB Environmental Services, Inc.

9312005S L6

WELL DEVELOPMENT RECORD

Project: FT DEVENS	Well Installation Date: 08/28/96		Project No. 9144.08
Client: USACE	Well Development Date: 09/11/96	Developed by: C. DaCosta	Checked by: KRR
Well/Site I.D.: 57M-96-09X	Weather: OVERCAST	Start Date: 09/11/96	Finish Date: 09/11/96
		Start Time: 1710	Finish Time: 1736

Well Construction Record Data:

- Bottom of Screen 22.8 ft.
- Sediment Sump/Plug 23.0 ft.
- Screen Length 10 ft.

From Ground Surface ☑ From top of Riser ☐

Well Diameter 2 in.

Fluids Lost During Drilling 0 gal.

Protective Casing Stick-up 2.74 ft. Protective Casing/Well Diff. 0.61 ft.

PID Readings: Ambient Air 0.0 ppm; Well Mouth 0.0 ppm

Water Levels:

- Initial 18.08 ft.
- End of Development 18.13 ft.
- 24 Hrs. After Development —— ft.

Sediment:

- Well Depth Before Development 25.5 ft. (from top of PVC)
- Well Depth After Development 25.73 ft.
- Sediment Depth Removed 0.23 ft.

HT of Water Column 7.42 ft. x ☐ 1.68* ☑ 0.9 = gal./vol. 7 *For 4" HSA installed wells

Equipment:

- ☑ Dedicated Submersible Pump
- ☐ Surge Block
- ☐ Bailer ☐ 2" ☐ ______
- ☐ Grundfos Pump 2" ____ 4" ____

Approximate Recharge Rate 1.75 gpm

Total Gallons Removed 35 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☑	☐
• Sediment thickness remaing in well is <1.0% of screen length	☑	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost NA	☐	☐

Notes: ______________________

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	ReDox	Pumping Rate
1715	7gal	7gal	5.69	13.6	42	60	230	1.5
1720	7gal	14gal	5.51	12.8	42	5	257	1.5
1725	7gal	21gal	5.42	12.6	42	0	289	1.5
1730	7gal	28gal	5.42	12.4	43	0	302	1.5
1735	7gal	35gal	5.42	12.4	42	0	314	1.5

Well Developer's Signature ______________________

WELL DEVELOPMENT RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

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WELL DEVELOPMENT RECORD

Project: FT DEVENS	Well Installation Date: 08/30/96		Project No. 9144.08
Client: USACE	Well Development Date: 09/11/96	Developed by: [illegible]	Checked by: [illegible]
Well/Site I.D.: 57M-96-10X	Weather: CLOUDY	Start Date: 09/11/96	Finish Date: 09/11/96
		Start Time: 0900	Finish Time: 1346

Well Construction Record Data:

Bottom of Screen	13 ft.	From Ground Surface ☑
Sediment Sump/Plug	13 ft.	From top of Riser ☐
Screen Length	10 ft.	

Well Diameter 2 in.

Fluids Lost During Drilling 0 gal.

Protective Casing Stick-up 2.21 ft. Protective Casing/Well Diff. 0.2 ft.

PID Readings: Ambient Air 0.0 ppm; Well Mouth 1.4 ppm

Water Levels:

Initial	7.53 ft.
End of Development	13 ~~[illegible]~~ ft.
24 Hrs. After Development	ft.

Sediment:

Well Depth Before Development	~~15.65~~ 15.56 ft.
Well Depth After Development	15.56 ft.
Sediment Depth Removed	0 ft.

(from top of PVC)

HT of Water Column 8.12 ft. x ☐ 1.68* ☑ 0.9 = gal./vol. 7

*For 4" HSA installed wells

Equipment:

- ☑ Dedicated Submersible Pump
- ☐ Surge Block
- ☐ Bailer ☐ 2" ☐ ______
- ☐ Grundfos Pump 2" ___ 4" ___

Approximate Recharge Rate 0.1 gpm

Total Gallons Removed 35 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☐	☑
• Sediment thickness remaing in well is <1.0% of screen length	☑	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost (NA)	☐	☐

Notes: WELL GONE DRY AFTER ~5 gal
SLOW RECHARGE

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	ORP	Pumping Rate
0900	7 gal	7 gal	5.58	12.7	68	667	30	
1010	7 gal	14 gal	5.63	11.6	36	203	316	
1240	7 gal	21 gal	5.75	12.5	49	707	161	
1315	7 gal	28 gal	5.54	12.1	33	591	177	
1345	7 gal	35 gal	5.54	11.6	32	663	208	

Well Developer's Signature [signature]

WELL DEVELOPMENT RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9312005S L6

WELL DEVELOPMENT RECORD

Project: FT DEVENS	Well Installation Date: 08/30/96	Project No. 9144.08

Client: USACE	Well Development Date: 09/11/96	Developed by: C. DaCoqt	Checked by: RRR
Well/Site I.D.: 57M-96-11X	Weather: OVERCAST	Start Date: 09/11/96	Finish Date: 09/11/96

Well Construction Record Data:

- Bottom of Screen: 12 ft.
- Sediment Sump/Plug: 12 ft.
- Screen Length: 10 ft.

From Ground Surface ☑ From top of Riser ☐

Well Diameter: 2 in.

Fluids Lost During Drilling: 0 gal.

Start Time: 1140 Finish Time: 1550

Protective Casing Stick-up: 2.48 ft. Protective Casing/Well Diff.: 0.54 ft.

PID Readings: Ambient Air 0.0 ppm; Well Mouth 0.5 ppm

Water Levels:

- Initial: 3.68 ft.
- End of Development: 9.13 ft.
- 24 Hrs. After Development: —— ft.

Sediment:

- Well Depth Before Development: 14.59 ft. (from top of PVC)
- Well Depth After Development: 14.59 ft.
- Sediment Depth Removed: Ø ft.

HT of Water Column 10.91 ft. x ☐ 1.68* ☑ 0.9 = gal./vol. 10

*For 4" HSA installed wells

Equipment:

- ☑ Dedicated Submersible Pump
- ☐ Surge Block
- ☐ Bailer ☐ 2" ☐ ______
- ☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: 0.17 gpm

Total Gallons Removed: 50 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☐	☑
• Sediment thickness remaing in well is <1.0% of screen length	☑	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost NA	☐	☐

Notes: WELL DRY AFTER ~5gal

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	2100X	Pumping Rate
1250	10 gal	10gal	5.92	12.3	102	>1000	56	
1358	10gal	20gal	6.02	13.6	99	487	90	
1450	10gal	30gal	5.99	12.4	106	479	57	
1525	10gal	40 gal	5.85	12.4	98	408	78	
1550	10gal	50gal	5.81	12.5	103	175	60	

Well Developer's Signature [signature]

WELL DEVELOPMENT RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

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WELL DEVELOPMENT RECORD

Project: FORT DEVENS	Well Installation Date: 08/29/94		Project No. 9144.08
Client: USACE	Well Development Date: 09/11/94	Developed by: C. Delorey	Checked by: RRR
Well/Site I.D.: 57M-96-12X	Weather: OVERCAST	Start Date: 09/11/96	Finish Date: 09/11/96
		Start Time: 1415	Finish Time: 1641

Well Construction Record Data:

Bottom of Screen 12 ft.
Sediment Sump/Plug 12 ft. — From Ground Surface ☑ From top of Riser ☐
Screen Length 10 ft.

Well Diameter 2 in.

Fluids Lost During Drilling 0 gal.

Protective Casing Stick-up 3.05 ft. Protective Casing/Well Diff. 0.25 ft.

PID Readings: Ambient Air 0.0 ppm; Well Mouth 0.5 ppm

Water Levels:
Initial 5.35 ft.
End of Development 6.12 ft.
24 Hrs. After Development —— ft.

Sediment:
Well Depth Before Development 15.13 ft. (from top of PVC)
Well Depth After Development 15.13 ft.
Sediment Depth Removed ∅ ft.

HT of Water Column 9.78 ft. x ☐ 1.68* ☑ .09 = gal./vol. 4

*For 4" HSA installed wells

Equipment:
☑ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ______
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 0.375 gpm
Total Gallons Removed 45 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☐	☑
• Sediment thickness remaing in well is <1.0% of screen length	☑	☐
• Total water removed = a minimum (NA) of 5x calculated well volume plus 5x drilling fluid lost	☐	☐

Notes:______________________________

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	NTU	Pumping Rate
1440	9 gal	9 gal	6.00	12.8	50	566	70	
1505	9 gal	18 gal	5.72	11.9	51	812	122	
1550	9 gal	27 gal	5.79	11.9	51	630	59	
1605	9 gal	36 gal	5.74	12.2	50	574	79	
1640	9 gal	45 gal	5.74	12.5	49	471	208	

Well Developer's Signature ____________

WELL DEVELOPMENT RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9312005S L6

WELL DEVELOPMENT RECORD

Project: FORT DEVENS	Well Installation Date: 08/29/96	Project No. 9144.08
Client: USACE	Well Development Date: 09/12/96	Developed by: C. DeVogt / Checked by: RRR
Well/Site I.D.: 57M-96-13X	Weather: OVERCAST	Start Date: 09/12/96 / Finish Date: 09/12/96
		Start Time: 0845 / Finish Time: 0946

Well Construction Record Data:

- Bottom of Screen: 12 ft.
- Sediment Sump/Plug: 12 ft.
- Screen Length: 10 ft.

—From Ground Surface ☑ From top of Riser ☐

Well Diameter: 2 in.

Fluids Lost During Drilling: ∅ gal.

Protective Casing Stick-up: 2.62 ft. Protective Casing/Well Diff.: 0.37 ft.

PID Readings: Ambient Air 0.0 ppm; Well Mouth 0.0 ppm

Water Levels:

- Initial: 5.11 ft.
- End of Development: 5.8 ft.
- 24 Hrs. After Development: —— ft.

HT of Water Column: 9.72 ft. x ☐ 1.68* ☑ .09 = gal./vol. 9

*For 4" HSA installed wells

Sediment:

- Well Depth Before Development: 14.78 ft. (from top of PVC)
- Well Depth After Development: 14.84 ft.
- Sediment Depth Removed: 0.06 ft.

Equipment:

- ☑ Dedicated Submersible Pump
- ☐ Surge Block
- ☐ Bailer ☐ 2" ☐ ______
- ☐ Grundfos Pump 2"____ 4"____

Approximate Recharge Rate: 0.75 gpm

Total Gallons Removed: 45 gal.

Well Development Criteria Met:

	yes	no
• Well water clear to unaided eye	☑	☐
• Sediment thickness remaing in well is <1.0% of screen length	☑	☐
• Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost (NA)	☐	☐

Notes: SLOW RECHARGE

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measuments

Record at the start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductivity	Turbidity	REDOX	Pumping Rate
0845	9 gal	9 gal	7.00	12.5	80	220	261	
0900	9 gal	18 gal	6.18	12.3	71	250	233	
0915	9 gal	27 gal	5.97	12.4	68	>1000	246	
0930	9 gal	36 gal	5.99	12.2	69	49	237	
0945	9 gal	45 gal	5.88	12.1	68	6	234	

Well Developer's Signature [signature]

WELL DEVELOPMENT RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS

—ABB Environmental Services, Inc.—

9312005S L6

FIELD SAMPLE DATA RECORDS (GROUNDWATER AND 1998 SOILS)

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Sunny, 40s | LOCATION ACTIVITY: START 1254 END ~~1530~~ 1440

SITE ID: 57M-95-01X | FIELD SAMPLE NUMBER: MX5701X1 | DATE: 10-30-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH: 29.0 FT
WATER DEPTH: 22.31 FT
HEIGHT OF WATER COLUMN: 6.7 FT

MEASURED FROM: [X] TOP OF WELL (riser) [ ] TOP OF CASING

WELL DIAMETER = 4"

[X] x 1.68 gal/ft (4" well) = 11.3 gal, +3 (filter pack) = 14 gal GAL/VOL
[ ] x ____ gal/ft (well)

PID HEADSPACE READINGS

BREATHING ZONE: 0.0 ppm
WELL HEAD: 0.0 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.3 FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	X	
WELL LOCKED	X	
PVC WELL CAP PRESENT	X	

POTECTIVE CASINGE/WELL DIFFERENCE: 0.4 FT

PURGE DATA	initial	1	2	3	4	5		
VOLUME # / TIME	13:02	13:18	13:35	13:57	14:13	14:30		
GALLONS	0	14	28	42	56	70		
TEMPERATURE, deg. C	13.8	13.8	13.9	13.8	13.8	13.7		
pH units	6.5	5.6	5.75	5.87	5.80	5.87		
SPECIFIC CONDUCTIVITY, umho/cm	110	104	98	81	85	84		
TURBIDITY* ntu	Not measured	* →						
REDOX (AT COMPLETION OF PURGING) mV		327.9						

SAMPLE OBSERVATION

[X] CLEAR
[ ] TURBID
[ ] COLORED ____
[ ] ODOR
[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B CONTROL # 167
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	~~1- 1L Poly~~ 2-1L AG	M N

[X] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:
[X] ELECTRIC CONDUCTIVITY PROBE
[ ] FLOAT ACTIVATED
[ ] OTHER ____

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

* Did not have a turbidity meter

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Sunny, 40s | LOCATION ACTIVITY: START 1542 END ~~1722~~ 1658

SITE ID: 57M-95-02X | FIELD SAMPLE NUMBER: MX5702X1 | DATE: 10-30-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH	25 FT	MEASURED FROM: [X] TOP OF WELL (riser)	PID HEADSPACE READINGS: BREATHING ZONE 0.0 ppm
WATER DEPTH	16.09 FT	[ ] TOP OF CASING	WELL HEAD 0.0 ppm
HEIGHT OF WATER COLUMN	8.9 FT	WELL DIAMETER = 4"	PROTECTIVE CASING STICK-UP FROM GROUND 2.8 FT

[X] x 1.68 gal/ft (4" well) = 15 gal + ≈3 gal (filter pack) ≈ 18 gal GAL/VOL
[ ] x ____ gal/ft (well)

WELL INTEGRITY	YES	NO
PROTECTIVE CASING SECURE	X	
WELL LOCKED	X	
PVC WELL CAP PRESENT	X	

POTECTIVE CASINGE/WELL DIFFERENCE: 0.5 FT

PURGE DATA

VOLUME # / TIME	1 15:52	2 16:03	3 16:12	4 16:31	5 16:46			
GALLONS	18	36	54	72	90			
TEMPERATURE, deg. C	14.4	14.5	14.5	14.5	14.5			
pH units	6.38	6.36	6.38	6.36	6.36			
SPECIFIC CONDUCTIVITY, umho/cm	329	323	321	315	310			
TURBIDITY' ntu	6	3	9	3	3			
REDOX (AT COMPLETION OF PURGING) mV	284.1							

SAMPLE OBSERVATION: [X] CLEAR [ ] TURBID [ ] COLORED ____ [ ] ODOR [ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	~~1- 1L Poly~~ 2-1L AG	M N

CONTROL # 169

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:
[X] ELECTRIC CONDUCTIVITY PROBE
[ ] FLOAT ACTIVATED
[ ] OTHER ____

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Rain, 50s | LOCATION ACTIVITY: START 1330 END 1630*

SITE ID: 57M-95-03X | FIELD SAMPLE NUMBER: MX5703X1 | DATE: 11-2-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH: ____ FT

WATER DEPTH: 10.94 FT

HEIGHT OF WATER COLUMN: ____ FT

[X] x 1.68 gal/ft (4" well) = 15.4 GAL/VOL

[ ] x ____ gal/ft (well)

MEASURED FROM

[X] TOP OF WELL

[ ] TOP OF CASING

WELL DIAMETER = 4"

PID HEADSPACE READINGS

BREATHING ZONE: 0.0 ppm

WELL HEAD: 0.0 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.8 FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	X	
WELL LOCKED	X	
PVC WELL CAP PRESENT	X	

POTECTIVE CASINGE/WELL DIFFERENCE: 0.3 FT

PURGE DATA

VOLUME #	initial (13:30)	1 (13:49)	2 (14:41)	3 (14:57)	4 (15:57)	5 (16:25)		
GALLONS	0	15.4	30.8	46.2	61.6	77.0		
TEMPERATURE, deg. C	11.8	12.2	12.0	12.1	12.0	12.0		
pH units	5.58	6.06	6.01	6.01	5.91	5.94		
SPECIFIC CONDUCTIVITY, umho/cm	0.114	0.152	0.160	0.156	0.152	0.151		
TURBIDITY' ntu	92	24	4	1	2	0		

REDOX (AT COMPLETION OF PURGING): not measured (lost KCl solution in redox probe)

SAMPLE OBSERVATION

[X] CLEAR

[ ] TURBID

[ ] COLORED

[X] ODOR **

[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	2- 1L AG	M N

CONTROL # 171 PP

[ ] IF MS/MSD COLLECTED

[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

[X] ELECTRIC CONDUCTIVITY PROBE

[ ] FLOAT ACTIVATED

[ ] OTHER ____

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

* Sample containers were mis-labelled with the incorrect time "17:30". The actual time of collection was 16:30.

** Very strong petroleum-like/solvent-like odor.

SAMPLERS SIGNATURE: Sarah Montgomery

Sam

Purged water was placed in drums.

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Drizzle, windy, 50s | LOCATION ACTIVITY: START 1255 END 1345

SITE ID: 57M-95-04A | FIELD SAMPLE NUMBER: MX5704A1 | DATE: 11-1-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH: ____ FT

WATER DEPTH: 3.12 FT

HEIGHT OF WATER COLUMN: ____ FT

[X] x 1.68 gal/ft (4" well) = 18.0 GAL/VOL
[ ] x ____ gal/ft (well)

MEASURED FROM

[X] TOP OF WELL
[ ] TOP OF CASING

WELL DIAMETER = 4"

PID HEADSPACE READINGS

BREATHING ZONE: 0.0 ppm

WELL HEAD: 0.1 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 1.5 FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	X	
WELL LOCKED	X	
PVC WELL CAP PRESENT	X	

POTECTIVE CASINGE/WELL DIFFERENCE: 0.4 FT

PURGE DATA

VOLUME #	1 (13:03)	2 (13:19)	3 (14:01)	4 (14:22)	5 (14:54)		
GALLONS	18	36	54	72	90		
TEMPERATURE, deg. C	12.9	13.2	13.0	13.3	13.2		
pH units	5.97	5.90	5.91	5.83	5.85		
SPECIFIC CONDUCTIVITY, umho/cm	0.093	0.090	0.088	0.089	0.085		
TURBIDITY' ntu	3	0	0	0	0		

REDOX (AT COMPLETION OF PURGING): 191.4 mV

SAMPLE OBSERVATION

[X] CLEAR
[ ] TURBID
[ ] COLORED ____
[ ] ODOR
[X] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	2- 1L AG	M N

CONTROL # 173

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

[X] ELECTRIC CONDUCTIVITY PROBE
[ ] FLOAT ACTIVATED
[ ] OTHER ____

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

- Iridescent sheen on water surface. Purged water was placed in drums.
- Alternated between purging this well and purging 57M-95-08A.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Drizzle, windy, 50s | LOCATION ACTIVITY: START 15:00 END ~~14~~ 1650

SITE ID: 57M-95-04B | FIELD SAMPLE NUMBER: ~~57~~ MX57 04B1 | DATE: 11-1-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH: ____ FT

WATER DEPTH: 3.96 FT

HEIGHT OF WATER COLUMN: ____ FT

MEASURED FROM: [X] TOP OF WELL [ ] TOP OF CASING

WELL DIAMETER = 4"

[X] x 1.68 gal/ft (4" well) = 35 (34.8) GAL/VOL

[ ] x ____ gal/ft (well)

PID HEADSPACE READINGS

BREATHING ZONE: 0.0 ppm

WELL HEAD: 0.1 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.5 FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	X	
WELL LOCKED	X	
PVC WELL CAP PRESENT	X	

POTECTIVE CASINGE/WELL DIFFERENCE: 0.2 FT

PURGE DATA

VOLUME #	1 (15:20)	2 (15:38)	3 (15:56)	4 (16:16)	5 (17:00)			
GALLONS	35	70	105	140	175			
TEMPERATURE, deg. C	12.0	12.1	11.9	12.1	11.9			
pH units	5.86	5.77	5.80	5.72	5.68			
SPECIFIC CONDUCTIVITY, umho/cm	0.213	0.214	~~0.210~~ 0.213	0.210	0.207			
TURBIDITY' ntu	1	0	0	0	0			
REDOX (AT COMPLETION OF PURGING)		345						

SAMPLE OBSERVATION: [X] CLEAR [ ] TURBID [ ] COLORED ____ [ ] ODOR [ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	2- 1L AG	M N

CONTROL # 185 PP

[ ] IF MS/MSD COLLECTED

[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

[X] ELECTRIC CONDUCTIVITY PROBE

[ ] FLOAT ACTIVATED

[ ] OTHER ____

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: ____

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Rain, 50s | LOCATION ACTIVITY: START 0835 END 0935

SITE ID: 57M-95-05X | FIELD SAMPLE NUMBER: MX5705X1 | DATE: 11-2-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH: ____ FT

WATER DEPTH: 15.53 FT

HEIGHT OF WATER COLUMN: ____ FT

MEASURED FROM: [X] TOP OF WELL [ ] TOP OF CASING

WELL DIAMETER = 4"

[X] x 1.68 gal/ft (4" well) = 11.4 GAL/VOL
[ ] x ____ gal/ft (well)

PID HEADSPACE READINGS

BREATHING ZONE: 0.0 ppm

WELL HEAD: 0.0 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.9 FT

WELL INTEGRITY (YES / NO)

PROTECTIVE CASING SECURE: [X] YES [ ] NO

WELL LOCKED: [X] YES [ ] NO

PVC WELL CAP PRESENT: [X] YES [ ] NO

POTECTIVE CASINGE/WELL DIFFERENCE: 0.5 FT

PURGE DATA

VOLUME #	1 (08:39)	2 (08:47)	3 (08:56)	4 (09:04)	5 (09:13)			
GALLONS	11.4	22.8	34.2	45.6	57.0			
TEMPERATURE, deg. C	13.5	13.9	13.8	13.8	14.1			
pH units	5.68	5.81	5.81	5.82	5.84			
SPECIFIC CONDUCTIVITY, umho/cm	0.100	0.085	0.085	0.086	0.086			
TURBIDITY' ntu	0	0	0	0	0			
REDOX (AT COMPLETION OF PURGING)		324.9	mV					

SAMPLE OBSERVATION

[X] CLEAR
[ ] TURBID
[ ] COLORED ____
[ ] ODOR
[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	[X]	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	[X]	UW19	EC	4C	2- 1L AG	C D
VOC	[X]	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	[X]	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	[X]	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	[X]	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	[X]	418.1	C	H2SO4 pH<2	2- 1L AG	M N

CONTROL # 175[illegible]

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:
[X] ELECTRIC CONDUCTIVITY PROBE
[ ] FLOAT ACTIVATED
[ ] OTHER ____

PURGING	SAMPLING	
[X]	[X]	DEDICATED SUBMIRSABLE PUMP (WHALE)
[ ]	[X]	DEDICATED TEFLON BAILER
[ ]	[X]	IN-LINE FILTER (INORGANICS)
[ ]	[ ]	OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Rain, 50s ?

LOCATION ACTIVITY: START ~~0835~~ 0952 | END 1110

SITE ID: 57M-95-06X | FIELD SAMPLE NUMBER: ~~57M~~ ~~57~~ 06X1 MX57 | DATE: 11-2-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA		MEASURED FROM	PID HEADSPACE READINGS		WELL INTEGRITY	YES	NO
WELL DEPTH	FT	[X] TOP OF WELL	BREATHING ZONE	0.0 ppm	PROTECTIVE CASING SECURE	X	
WATER DEPTH	13.83 FT	[ ] TOP OF CASING	WELL HEAD	0.0 ppm	WELL LOCKED	X	
HEIGHT OF WATER COLUMN	FT	WELL DIAMETER = 4"			PVC WELL CAP PRESENT	X	

[X] x 1.68 gal/ft (4" well) = 18.2 GAL/VOL
[ ] x ____ gal/ft (well)

PROTECTIVE CASING STICK-UP FROM GROUND: 2.3 FT

POTECTIVE CASINGE/WELL DIFFERENCE: 0.2 FT

PURGE DATA VOLUME #	Initial (0952)	1 (1005)	2 (1016)	3 (1032)	4 (1049)	5 (1101)		
GALLONS	0	18.2	36.4	54.6	72.8	91.0		
TEMPERATURE, deg. C	12.4	13.2	13.4	13.5	13.4	13.0		
pH units	0.088	0.085	0.086	0.088	0.089	0.090		
SPECIFIC CONDUCTIVITY, umho/cm	5.87	5.96	5.97	6.00	5.97	5.93		
TURBIDITY' ntu	9	3	0	0	0	0		
REDOX (AT COMPLETION OF PURGING)	277.4	mV						

SAMPLE OBSERVATION
- [X] CLEAR
- [ ] TURBID
- [ ] COLORED ____
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER 177PP
SVOCS	X	UM18	MS	4C	2- 1L AG	A B CONTROL # ~~PP~~ PP
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	2- 1L AG	M N

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:	PURGING	SAMPLING	
[X] ELECTRIC CONDUCTIVITY PROBE	X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
[ ] FLOAT ACTIVATED		X	DEDICATED TEFLON BAILER
[ ] OTHER ____		X	IN-LINE FILTER (INORGANICS)
			OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Cloudy, 40s | LOCATION ACTIVITY: START 1536 END 1640

SITE ID: 57M-95-07X | FIELD SAMPLE NUMBER: MX5707X1 | DATE: 10-31-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH		FT
WATER DEPTH	3.49	FT
HEIGHT OF WATER COLUMN		FT

MEASURED FROM: [X] TOP OF WELL [ ] TOP OF CASING

WELL DIAMETER = 4"

[X] x 1.68 gal/ft (4" well) = 19.0 GAL/VOL

[ ] x ____ gal/ft (well)

PID HEADSPACE READINGS

- BREATHING ZONE: 0.0 ppm
- WELL HEAD: 0.1 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 1.5 FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	X	
WELL LOCKED	X	
PVC WELL CAP PRESENT	X	

POTECTIVE CASINGE/WELL DIFFERENCE: 0.3 FT

PURGE DATA

VOLUME #	initial (1536)	~~19.0~~ 1 (1545)	~~38.0~~ 2 (1557)	~~57.0~~ 3 (1609)	~~76.0~~ 4 (1624)	~~95.0~~ 5		
GALLONS	0	19.0	38.0	57.0	76.0	95.0		
TEMPERATURE, deg. C	13.2	13.3	13.4	13.4	13.3			
pH units	5.56	5.59	5.53	5.52	5.59			
SPECIFIC CONDUCTIVITY, umho/cm	0.136	0.137	0.133	0.133	0.137			
TURBIDITY' ntu	0	0	0	0	0			
REDOX (AT COMPLETION OF PURGING)								

SAMPLE OBSERVATION

- [X] CLEAR
- [ ] TURBID
- [ ] COLORED ____
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	2- 1L AG	M N

CONTROL # 17

[ ] IF MS/MSD COLLECTED

[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

- [X] ELECTRIC CONDUCTIVITY PROBE
- [ ] FLOAT ACTIVATED
- [ ] OTHER ____

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Drizzle, windy, 50s | LOCATION ACTIVITY: START 0800 END 1345

SITE ID: 57M-95-08A | FIELD SAMPLE NUMBER: MX570841 | DATE: 11-1-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH: FT

WATER DEPTH: 3.0 FT

HEIGHT OF WATER COLUMN: FT

[X] x 1.68 gal/ft (4" well) = 20.8 GAL/VOL

[ ] x ____ gal/ft (well)

MEASURED FROM

[X] TOP OF WELL

[ ] TOP OF CASING

WELL DIAMETER = 4"

PID HEADSPACE READINGS

BREATHING ZONE: 0.0 ppm

WELL HEAD: 0.5 ~~0.0~~ ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 1.4 ~~0.3~~ FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	X	
WELL LOCKED	X	
PVC WELL CAP PRESENT	X	

POTECTIVE CASINGE/WELL DIFFERENCE: 0.3 FT

PURGE DATA VOLUME #	initial (0800)	1 (0826)	2 (0920)	3 (1200)	4 (1230)	5 (1335)		
GALLONS	0	20.8	41.6	62.4	83.2	104.0		
TEMPERATURE, deg. C	12.1	11.6	12.1	11.7	12.3	12.1		
pH units	5.36	5.57	5.55	5.87	5.93	5.89		
SPECIFIC CONDUCTIVITY, umho/cm	0.129	~~0.072~~	0.078	0.076	0.069	0.075		
TURBIDITY' ntu	43	~~98~~ 1	3	4	9	0		
REDOX (AT COMPLETION OF PURGING)		243.0	mV					

SAMPLE OBSERVATION

[X] CLEAR

[ ] TURBID

[ ] COLORED ______

[ ] ODOR

[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A, B
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C, D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E, F, G, H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	2- 1L AG	M, N

CONTROL # 181

[ ] IF MS/MSD COLLECTED

[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

[X] ELECTRIC CONDUCTIVITY PROBE

[ ] FLOAT ACTIVATED

[ ] OTHER ______

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ______

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

- Slow recharge; alternated between purging this well and purging 57M-95-08B.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Drizzle, windy, 50s | LOCATION ACTIVITY: START 0850 END 1155

SITE ID: 57M-95-08B | FIELD SAMPLE NUMBER: MX5708B1 | DATE: 11-1-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH	FT
WATER DEPTH	3.82 FT
HEIGHT OF WATER COLUMN	FT
[X] x 1.68 gal/ft (4" well) =	34.7 GAL/VOL
[ ] x ____ gal/ft (well)	

MEASURED FROM: [X] TOP OF WELL [ ] TOP OF CASING

WELL DIAMETER = 4"

PID HEADSPACE READINGS

BREATHING ZONE: 0.0 ppm

WELL HEAD: 0.0 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.8 FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	X	
WELL LOCKED	X	
PVC WELL CAP PRESENT	X	

POTECTIVE CASINGE/WELL DIFFERENCE: 0.5 FT

PURGE DATA

VOLUME #	initial (0850)	(0912)	2 (0940)	3 (1008)	4 (1053)	5 (1134)		
GALLONS	0	34.7	69.4	104.1	138.8	173.5		
TEMPERATURE, deg. C	10.9	11.1	11.3	11.3	11.3	11.0		
pH units	5.49	5.53	5.70	5.74	5.80	5.91		
SPECIFIC CONDUCTIVITY, umho/cm	0.228	0.224	0.222	0.217	0.218	0.219		
TURBIDITY' ntu	6	0	1	0	2	0		
REDOX (AT COMPLETION OF PURGING)		277 mV						

SAMPLE OBSERVATION

[X] CLEAR
[ ] TURBID
[ ] COLORED ____
[ ] ODOR
[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B CONTROL # 183
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	2- 1L AG	M N

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:
[X] ELECTRIC CONDUCTIVITY PROBE
[ ] FLOAT ACTIVATED
[ ] OTHER ____

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

– Alternated between purging this well and purging 57M-95-03A.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Partly cloudy, 40s | LOCATION ACTIVITY: START 0900 END 1030

SITE ID: G3M--92--02X | FIELD SAMPLE NUMBER: MXG302X1 | DATE: 10-31-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH: 33.38 FT

WATER DEPTH: 26.95 FT

HEIGHT OF WATER COLUMN: 6.43 FT

MEASURED FROM: [X] TOP OF WELL [ ] TOP OF CASING

WELL DIAMETER = 4"

[X] x 1.68 gal/ft (4" well) = 14.0 GAL/VOL

[ ] x ____ gal/ft (well)

PID HEADSPACE READINGS

BREATHING ZONE: 0.0 ppm

WELL HEAD: 0.0 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.3 FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	X	
WELL LOCKED	X	
PVC WELL CAP PRESENT	X	

POTECTIVE CASINGE/WELL DIFFERENCE: 0.3 FT

PURGE DATA

VOLUME #	initial (0900)	1 (0916)	2 (0931)	3 (0946)	4 (1003)	5		
GALLONS	0	14	28	42	56	70		
TEMPERATURE, deg. C	12.8	12.9	12.9	12.9	12.9	12.9		
pH units	5.96	6.01	5.99	5.99	5.99	5.99		
SPECIFIC CONDUCTIVITY, ~~umho/cm~~ (mS/cm)	0.195	0.158	0.140	0.146	0.139	0.147		
TURBIDITY' ntu	2	Ø	Ø	Ø	Ø	Ø		
REDOX (AT COMPLETION OF PURGING) (mV)	330.7							

SAMPLE OBSERVATION

[X] CLEAR
[ ] TURBID
[ ] COLORED ____
[ ] ODOR
[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM.	X	*	C	4C	1- 1L Poly	K
/ TDS		160.1	S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	2- 1L AG	M N

CONTROL # 163

[ ] IF MS/MSD COLLECTED

[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

[X] ELECTRIC CONDUCTIVITY PROBE
[ ] FLOAT ACTIVATED
[ ] OTHER ____

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah J. Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Partly cloudy, 40s | LOCATION ACTIVITY: START 1136 END 13:15

SITE ID: G3M-92-07X | FIELD SAMPLE NUMBER: MXG307X1 | DATE: 10-31-95 | STUDY AREA (AOC): 57

WATER LEVEL / WELL DATA

WELL DEPTH: 27.65 FT

WATER DEPTH: 34.42 FT

HEIGHT OF WATER COLUMN: 6.77 FT

MEASURED FROM: [X] TOP OF WELL [ ] TOP OF CASING

WELL DIAMETER = 4"

[X] x 1.68 gal/ft (4" well) = 14.7 GAL/VOL

[ ] x ____ gal/ft (well)

PID HEADSPACE READINGS

BREATHING ZONE: 0.0 ppm

WELL HEAD: 0.0 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.3 FT

WELL INTEGRITY (YES / NO)

PROTECTIVE CASING SECURE: [X] YES [ ] NO

WELL LOCKED: [X] YES [ ] NO

PVC WELL CAP PRESENT: [X] YES [ ] NO

POTECTIVE CASING/WELL DIFFERENCE: 0.2 FT

PURGE DATA

VOLUME #	initial (11:36)	1 (12:50)	2 (12:06)	3 (12:23)	4 (12:48)	5		
GALLONS	0	14.7	29.4	44.1	58.8	73.5		
TEMPERATURE, deg. C	13.8	13.9	13.9	13.9	13.9			
pH units	5.96	6.01	6.02	6.02	6.02			
SPECIFIC CONDUCTIVITY, umho/cm	0.259	0.254	0.260	0.260	0.261			
TURBIDITY' ntu	1	0	0	0	0			
REDOX (AT COMPLETION OF PURGING) (mV)	291.5							

SAMPLE OBSERVATION

[X] CLEAR
[ ] TURBID
[ ] COLORED ____
[ ] ODOR
[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	2- 1L AG	M N

CONTROL # 165 (Dup: 448)

[ ] IF MS/MSD COLLECTED

[X] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

[X] ELECTRIC CONDUCTIVITY PROBE
[ ] FLOAT ACTIVATED
[ ] OTHER ____

PURGING	SAMPLING	
X	X	DEDICATED SUBMIRSABLE PUMP (WHALE)
	X	DEDICATED TEFLON BAILER
	X	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah J. Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: clear, windy, 10°C | LOCATION ACTIVITY: START 1145 END 1330

SITE ID: 57M-95-01X | FIELD SAMPLE NUMBER: MD5701X2 | DATE: 2/13/96 | STUDY AREA (AOC): SA 57

WATER LEVEL / WELL DATA

WELL DEPTH ____ FT
WATER DEPTH ____ FT
HEIGHT OF WATER COLUMN ____ FT
☐ x 1.68 gal/ft (4" well) = ____ GAL/VOL
☐ x ____ gal/ft (well)

MEASURED FROM
☐ TOP OF WELL
☐ TOP OF CASING
WELL DIAMETER = ____

PID HEADSPACE READINGS
BREATHING ZONE ____ ppm
WELL HEAD ____ ppm
PROTECTIVE CASING STICK-UP FROM GROUND ____ FT

WELL INTEGRITY (YES / NO)
PROTECTIVE CASING SECURE
WELL LOCKED
PVC WELL CAP PRESENT
POTECTIVE CASINGE/WELL DIFFERENCE ____ FT

PURGE DATA								
VOLUME #								
GALLONS								
TEMPERATURE, deg. C								
pH units								
SPECIFIC CONDUCTIVITY, umho/cm								
TURBIDITY, ntu								
REDOX (AT COMPLETION OF PURGING)								

NA

SAMPLE OBSERVATION
☐ CLEAR
☐ TURBID
☐ COLORED ____
☐ ODOR
☐ OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	✓	UM18	MS	4C	2- 1L AG	A B CONTROL # 455
PEST./PCBS	✓	UW19	EC	4C	2- 1L AG	C D
VOC	✓	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	✓	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	✓	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	✓	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	✓	418.1	C	H2SO4 pH<2	1- 1L Poly	M N

☐ IF MS/MSD COLLECTED
☐ IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:
☑ ELECTRIC CONDUCTIVITY PROBE
☐ FLOAT ACTIVATED
☐ OTHER ____

PURGING / SAMPLING
☐ ☐ DEDICATED SUBMIRSABLE PUMP (WHALE)
☐ ☐ DEDICATED TEFLON BAILER
☐ ☐ IN-LINE FILTER (INORGANICS)
☐ ☐ OTHER ____

NA

NUMBER OF IN-LINE FILTERS USED: ____

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Field duplicate for 57M-95-01X

SAMPLERS SIGNATURE: Nancy E. Roka/SM

GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens
Study Area: SA 57
Project Number: 9144.02
Date: 2/12/96
Sample Location ID: 57M-95-01X
Time: Start: 1145 End: ~~1320~~ 1330 (NR)
Signature of Sampler: NR/SM

Water Level/Well Data

Well Depth 31.1 Ft. ✓ Measured ___ Historical
✓ Top of Well ___ Top of Protective Casing
Well Riser Stick-up 1.78 Ft. (from ground)
Protective Casing/Well Difference -0.32 Ft.
Protective Casing 2.1 Ft.

Depth to Water 23.07 Ft.
Well Material: ✓ PVC ___ SS
Well Locked?: ✓ Yes ___ No
Well Dia. ✓ 2 inch ✓ 4 inch ___ 6 inch
Water Level Equip. Used: (taken 2/12/96) ✓ Elect. Cond. Probe ___ Float Activated ___ Press. Transducer

Height of Water Column 8.03 Ft. X ___ .16 Gal/Ft. (2 in.) ___ .65 Gal/Ft. (4 in.) ___ 1.5 Gal/Ft. (6 in.) ✓ 1.6 Gal/Ft. (4 in.) = 13.5 Gal/Vol; 70 Total Gal Purged

Well Integrity: Yes / No
Prot. Casing Secure ✓
Concrete Collar Intact ✓
Other ___

Equipment Documentation

Purging/Sampling Equipment Used: (✓ If Used For)

Purging	Sampling	Equipment	Equipment ID
		Peristaltic Pump	
		Submersible Pump	
	✓	Bailer	
		PVC/Silicon Tubing	
		Teflon/Silicon Tubing	
		Airlift	
	✓	Hand Pump	
	✓	In-line Filter	
		Press/Vac Filter	
✓	✓	whale pump	

Decontamination Fluids Used: (✓ All That Apply at Location)

___ Methanol (100%)
___ 25% Methanol/75% ASTM Type II water
___ Deionized Water
___ Liquinox Solution
___ Hexane
✓ HNO_3/D.I. Water Solution
✓ Potable Water
___ None

Field Analysis Data

Ambient Air VOC bkg ppm Well Mouth bkg ppm Field Data Collected ___ In-line ___ In Container
Sample Observations: ___ Turbid ___ Clear ___ Cloudy ___ Colored ___ Odor — initially turbid

Purge Data	@ 14 Gal.	@ 28 Gal.	@ 42 Gal.	@ 56 Gal.	@ 70 Gal.	0
Temperature, Deg. C	10.4	11.9	11.8	11.9	11.6	~~9.5~~ 9.7
pH, units	5.5	5.5	5.5	5.4	5.6	5.5
Specific Conductivity (umhos/cm. @ 25 Deg. C.)	105	105	109	110	115	87
Oxidation - Reduction, +/- mv					214	
Dissolved Oxygen, ppm	9.0	7.9	7.5	7.8	7.5	9.9
turbidity (ntu's)	1	0	0	0	0	

Sample Collection Requirements (✓ If Required at this Location)

Sample Bottle IDs (168)

Analytical Parameter	✓ If Field Filtered	Preservation Method	Volume Required	✓ If Sample Collected	Sample Bottle IDs
VOA		HCL	4040 ml	✓	E / F / G / H
SVOA		4C	2- liter AG	✓	A / B / /
Pest/PCB		4C	1-1 liter AG	✓	C / D / /
Inorganics	✓	HNO_3	3- 1 liter P	✓	I / J (NF) / /
Explosives		4°C	2- 1 liter AG		/ / /
TPH		H_2SO_4	2- 1 liter AG	✓	M / N / /
TOC		H_2SO_4	1- 2 liter P		/ / /
Nitrate		H_2SO_4	1- 2 liter P		/ / /
Notes:				✓ H_2O qual	K / L

92021590 (j) **ABB Environmental Services, Inc.**

- Purge H_2O headspace = 0.0 ppm
- Field duplicate collected at this location for all params (control # 455)

GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens
Study Area: SA 57
Project Number: 9144.02
Date: 2/13/96
Sample Location ID: 57M-95-02X
Time: Start: 1415 End: 1530
Signature of Sampler: MR/SM

Water Level/Well Data

Well Depth 26.5 Ft. ✓ Measured ___ Historical | ✓ Top of Well ___ Top of Protective Casing | Well Riser Stick-up 1.92 Ft. (from ground) | Protective Casing/Well Difference -0.48 Ft.

Protective Casing 2.4± Ft.

Depth to Water 17.51 Ft. | Well Material: ✓ PVC ___ SS | Well Locked?: ✓ Yes ___ No | Well Dia. ___ 2 inch ✓ 4 inch ___ 6 inch | Water Level Equip. Used: ✓ Elect. Cond. Probe ___ Float Activated ___ Press. Transducer (taken 2/12/96)

Height of Water Column 8.99 Ft. X ___ .16 Gal/Ft. (2 in.) ___ .65 Gal/Ft. (4 in.) ___ 1.5 Gal/Ft. (6 in.) ✓ 1.68 Gal/Ft. (4 in.) = 15.1 Gal/Vol; 75 Total Gal Purged

Well Integrity:	Yes	No
Prot. Casing Secure	✓	
Concrete Collar Intact	✓	
Other ___		

Equipment Documentation

Purging/Sampling Equipment Used:

(✓ If Used For)

Purging	Sampling		Equipment ID
		Peristaltic Pump	
	✓	Submersible Pump	
		Bailer	
		PVC/Silicon Tubing	
		Teflon/Silicon Tubing	
		Airlift	
		Hand Pump	
	✓	In-line Filter	
		Press/Vac Filter	
✓	✓	whale pump	

Decontamination Fluids Used:

(✓ All That Apply at Location)

- ___ Methanol (100%)
- ___ 25% Methanol/75% ASTM Type II water
- ___ Deionized Water
- ___ Liquinox Solution
- ___ Hexane
- ✓ HNO_3/D.I. Water Solution
- ✓ Potable Water
- ___ None

Field Analysis Data

Ambient Air VOC bkg ppm Well Mouth bkg ppm Field Data Collected ___ In-line ___ In Container

Sample Observations: ___ Turbid ___ Clear ___ Cloudy ___ Colored ___ Odor

Purge Data	@ 0 Gal.	@ 15 Gal.	@ 30 Gal.	@ 45 Gal.	@ 60 Gal.	75
Temperature, Deg. C	8.8	11.0	11.1	11.7	11.6	11.6
pH, units	5.9	5.9	5.8	5.8	5.8	5.9
Specific Conductivity (umhos/cm. @ 25 Deg. C.)	160	136	128	128	128	126
Oxidation - Reduction, +/- mv					217	
Dissolved Oxygen, ppm	7.36	7.8	9.3	9.0	9.1	8.4
Turbidity (ntu's)	49	0	0	0	0	0

Sample Collection Requirements

(✓ If Required at this Location)

Analytical Parameter	✓ If Field Filtered	Preservation Method	Volume Required	✓ If Sample Collected	Sample Bottle IDs (170)
VOA		HCL	4040 ml	✓	E / F / G / H
SVOA		40C	2- liter AG	✓	A / B / /
Pest/PCB		40C	1-1 liter AG	✓	C / D / /
Inorganics	✓	HNO_3	3- 1 liter P	✓	I / J(NF) / /
Explosives		4°C	2- 1 liter AG		/ / /
TPH		H_2SO_4	2- 1 liter AG	✓	M / N / /
TOC		H_2SO_4	1- 2 liter P		/ / /
Nitrate		H_2SO_4	1- 2 liter P		/ / /

Notes: ___ ✓ H_2O Qual K L

92021590 (j)

ABB Environmental Services, Inc.

Purge H_2O headspace ≈ 0.0 ppm

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Snow, 20° | LOCATION ACTIVITY: START ___ END 1300

SITE ID: 57M-95-03X | FIELD SAMPLE NUMBER: MD5703X2 | DATE: 2/14/96 | STUDY AREA (AOC): SA57

WATER LEVEL / WELL DATA		MEASURED FROM	PID HEADSPACE READINGS		WELL INTEGRITY	YES	NO
WELL DEPTH	FT	TOP OF WELL	BREATHING ZONE	ppm	PROTECTIVE CASING SECURE	✓	
WATER DEPTH	FT	TOP OF CASING			WELL LOCKED		
HEIGHT OF WATER COLUMN	FT	WELL DIAMETER =	WELL HEAD	ppm	PVC WELL CAP PRESENT		

x 1.68 gal/ft (4" well) = ___ GAL/VOL
x ___ gal/ft (well)

PROTECTIVE CASING STICK-UP FROM GROUND ___ FT

POTECTIVE CASINGE/WELL DIFFERENCE ___ FT

NA

PURGE DATA								
VOLUME #								
GALLONS								
TEMPERATURE, deg. C								
pH units								
SPECIFIC CONDUCTIVITY, umho/cm								
TURBIDITY' ntu								
REDOX (AT COMPLETION OF PURGING)								

SAMPLE OBSERVATION
- CLEAR
- TURBID
- COLORED ___
- ODOR
- OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	✓	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	✓	UW19	EC	4C	2- 1L AG	C D
VOC	✓	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	✓	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	✓	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	✓	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	✓	418.1	C	H2SO4 pH<2	1- 1L Poly	M N

CONTROL # 458

IF MS/MSD COLLECTED

IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:
- ELECTRIC CONDUCTIVITY PROBE
- FLOAT ACTIVATED
- OTHER ___

	PURGING	SAMPLING
DEDICATED SUBMIRSABLE PUMP (WHALE)		
DEDICATED TEFLON BAILER		
IN-LINE FILTER (INORGANICS)		
OTHER ___		

NUMBER OF IN-LINE FILTERS USED: ___

NA

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Duplicated of 57M-95-03X (MX5703X2)

SAMPLERS SIGNATURE Nancy E. Rotica / JJ

GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens   Study Area: SA 57
Project Number: 9144.02   Date: 2/14/96
Sample Location ID: 57M-95-03X
Time: Start: 1110   End: 13:00   Signature of Sampler: MR/JJ

Water Level/Well Data

Well Depth 19.5 Ft. ✓ Measured __ Historical   ✓ Top of Well __ Top of Protective Casing   Well Riser Stick-up 2.03 Ft. (from ground)   Protective −0.37 Ft. Casing/Well Difference

Protective Casing 2.4± Ft.

Depth to Water 9.73 Ft.   Well Material: ✓ PVC __ SS   Well Locked?: ✓ Yes __ No   Well Dia. __ 2 inch ✓ 4 inch __ 6 inch   Water Level Equip. Used: (taken 2/12/96) ~~✓~~ Elect. Cond. Probe (MR) __ Float Activated __ Press. Transducer ✓ ORS phase indicator probe

Height of Water Column 9.77 Ft. X __ .16 Gal/Ft. (2 in.) __ .65 Gal/Ft. (4 in.) __ 1.5 Gal/Ft. (6 in.) ✓ 1.6 Gal/Ft. (4 in.) = 16.4 Gal/Vol   80 Total Gal Purged

Well Integrity:	Yes	No
Prot. Casing Secure	✓	
Concrete Collar Intact	✓	
Other		

Equipment Documentation

Purging/Sampling Equipment Used: (✓ If Used For)

Purging	Sampling	Equipment	Equipment ID
		Peristaltic Pump	
	✓	Submersible Pump	
		Bailer	
		PVC/Silicon Tubing	
		Teflon/Silicon Tubing	
		Airlift	
		Hand Pump	
	✓	In-line Filter	
		Press/Vac Filter	
✓	✓	whale pump	

Decontamination Fluids Used: (✓ All That Apply at Location)

- __ Methanol (100%)
- __ 25% Methanol/75% ASTM Type II water
- __ Deionized Water
- __ Liquinox Solution
- __ Hexane
- ✓ HNO_3/D.I. Water Solution
- ✓ Potable Water
- __ None

ORP =111

Field Analysis Data

Ambient Air VOC bkg ppm   Well Mouth bkg ppm   Field Data Collected ✓ In-line ✓ In Container   Sample Observations: __ Turbid ✓ Clear ✓ Cloudy __ Colored ✓ Odor (old fuel)

Purge Data	@ 0 Gal.	@ 16 Gal.	@ 32 Gal.	@ 48 Gal.	@ 64 Gal.	80
Temperature, Deg. C	6.1	7.3	5.9	6.3	6.6	6.0
pH, units	4.76	5.1	5.1	5.18	5.29	5.15
Specific Conductivity (umhos/cm @ 25 Deg. C.)	68	81	84	84	92	79
Oxidation - Reduction, +/- mv						
Dissolved Oxygen, ppm	5.20	6.0	4.72	4.52	5.84	4.73
Turb.	cloudy	cloudy	c.	cloudy	cloudy	cloudy

Sample Collection Requirements (✓ If Required at this Location)

Analytical Parameter	✓ If Field Filtered	Preservation Method	Volume Required	✓ If Sample Collected	Sample Bottle IDs
VOA		HCL	4040 ml	✓	E / F / G / H
SVOA		40C	2- liter AG	✓	A / B / /
Pest/PCB		40C	1-1 liter AG	✓	C / D / /
Inorganics	✓	HNO_3	3- 1 liter P	✓	I / J (H) / /
Explosives		4°C	2- 1 liter AG		/ / /
TPH		H_2SO_4	2- 1 liter AG	✓	M / N / /
TOC		H_2SO_4	1- 2 liter P		/ / /
Nitrate		H_2SO_4	1- 2 liter P		/ / /

172

Notes: Had to replace pump (wouldn't start)

✓ H_2O Qual K L

92021590 (i)   ABB Environmental Services, Inc.

- Purge H_2O headspace = initial = bkg ∴ dumped vol. 1. Then smelled fuel odor. Headspace after 1 vol = 70 ppm
- Field duplicate collected for ~~TCL~~ all parameters (control #458) (MR)
- Recharge slightly slower than pump

GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens
Study Area: SA 57
Project Number: 9144.02
Date: 2/14/96
Sample Location ID: 57M-95-04A
Time: Start: 0850 End: 0945
Signature of Sampler: NR/JJ

Water Level/Well Data

Well Depth 13.2 Ft. ✓ Measured ___ Historical
✓ Top of Well ___ Top of Protective Casing
Well Riser Stick-up (from ground) 0.80 Ft.
Protective Casing/Well Difference ~0.40 Ft.
Protective Casing 1.2± Ft.

Depth to Water 2.75 Ft.
Well Material: ✓ PVC ___ SS
Well Locked?: ✓ Yes ___ No
Well Dia. ___ 2 inch ✓ 4 inch ___ 6 inch
Water Level Equip. Used: (taken 2/12/96) ___ Elect. Cond. Probe ___ Float Activated ___ Press. Transducer ✓ ORS phase indicator

Height of Water Column 10.45 Ft. X ___ .16 Gal/Ft. (2 in.) ___ .65 Gal/Ft. (4 in.) ___ 1.5 Gal/Ft. (6 in.) ✓ 1.65 Gal/Ft. (4 in.) = [17.6 Gal/Vol; 90 Total Gal Purged]

Well Integrity: | Yes | No
Prot. Casing Secure ✓
Concrete Collar Intact ✓
Other

Equipment Documentation

Purging/Sampling Equipment Used:

(✓ If Used For)

Purging	Sampling		Equipment ID
		Peristaltic Pump	
	✓	Submersible Pump	
		Bailer	
		PVC/Silicon Tubing	
		Teflon/Silicon Tubing	
		Airlift	
		Hand Pump	
	✓	In-line Filter	
	✓	Press/Vac Filter	
✓	✓	whale pump	

Decontamination Fluids Used:

(✓ All That Apply at Location)
___ Methanol (100%)
___ 25% Methanol/75% ASTM Type II water
___ Deionized Water
___ Liquinox Solution
___ Hexane
___ HNO_3/D.I. Water Solution
✓ Potable Water
___ None

Field Analysis Data

Ambient Air VOC bkg ppm Well Mouth bkg ppm Field Data Collected ✓ In-line ✓ In Container
Sample Observations: ___ Turbid ✓ Clear ___ Cloudy ___ Colored ___ Odor

Purge Data	@ 0 Gal.	@ ~~18~~ 24 (#2) Gal.	@ ~~36~~ 45 Gal.	@ 54 Gal.	@ 72 Gal.	90
Temperature, Deg. C	6.1	7.4	8.3	8.2	8.0	7.9
pH, units	5.01	5.2	5.08	5.27	5.03	5.05
Specific Conductivity (umhos/cm. @ 25 Deg. C.)	0.089	35	92	86	88	84
Oxidation - Reduction, +/- mv						
Dissolved Oxygen, ppm	—	2.3	2.9	3.8	2.5	2.77
Turb (ntu)	10	10	10	10	10	10

174 158 mV ORP

Sample Collection Requirements

(✓ If Required at this Location)

Analytical Parameter	✓ If Field Filtered	Preservation Method	Volume Required	✓ If Sample Collected	Sample Bottle IDs
VOA		HCL	4040 ml	✓	E / I / G / H
SVOA		4°C	2- liter AG	✓	A / B
Pest/PCB		4°C	1-1 liter AG	✓	C / D
Inorganics	✓	HNO_3	3- 1 liter P	✓	~~F~~ / J(FF)
Explosives		4°C	2- 1 liter AG		
TPH		H_2SO_4	2- 1 liter AG	✓	M / N
TOC		H_2SO_4	1- 2 liter P		
Nitrate		H_2SO_4	1- 2 liter P		
H2O Qual				✓	K / L

Notes:

92021590 (j) ABB Environmental Services, Inc.

Purge H_2O headspace = bkg
Turbidity not working?

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE_TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: overcast, snow 20°s | LOCATION ACTIVITY: START 0840 END 12:30

SITE ID: 57M-95-04B | FIELD SAMPLE NUMBER: MX5704B2 | DATE: 2/14/96 | STUDY AREA (AOC): SA 57

WATER LEVEL / WELL DATA

WELL DEPTH: 31.0± FT

WATER DEPTH: 3.56 FT

HEIGHT OF WATER COLUMN: 27.44 FT

☑ x 1.68 gal/ft (4" well) = 46.1 GAL/VOL

☐ x ____ gal/ft (well)

MEASURED FROM: ☑ TOP OF WELL ☐ TOP OF CASING

WELL DIAMETER = 4"

PID HEADSPACE READINGS

BREATHING ZONE: bkg ppm

WELL HEAD: bkg ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.1± FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	✓	
WELL LOCKED	✓	
PVC WELL CAP PRESENT	✓	

POTECTIVE CASINGE/WELL DIFFERENCE: -0.17 FT

PURGE DATA VOLUME #	—	1	2	3	4	5		
GALLONS	0	46	92	138	184	230		
TEMPERATURE, deg. C	5.9	11	11	10.6	10.7	11.0		
pH units	4.6	4.9	5.02	5.1	5.0	4.9		
SPECIFIC CONDUCTIVITY, umho/cm	300	277	266	263	257	254		
TURBIDITY' ntu	10	10	10	10	10	10		
REDOX (AT COMPLETION OF PURGING)		ORP = 198						
~~Turbidity (ntus)~~ DO (mg/L)	10.0	8.9	9.0	8.5	8.8	8.95		

SAMPLE OBSERVATION: ☑ CLEAR ☐ TURBID ☐ COLORED ☐ ODOR ☐ OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	✓	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	✓	UW19	EC	4C	2- 1L AG	C D
VOC	✓	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	✓	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	✓	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	✓	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	✓	418.1	C	H2SO4 pH<2	1- 1L Poly	M N

CONTROL # 459

☐ IF MS/MSD COLLECTED

☐ IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

☑ ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96)

☐ FLOAT ACTIVATED

☐ OTHER ______

	PURGING	SAMPLING
DEDICATED SUBMIRSABLE PUMP (WHALE)	✓	✓
DEDICATED TEFLON BAILER		✓
IN-LINE FILTER (INORGANICS)		✓
OTHER ______		

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

- Purge H_2O headspace = bkg
- Turbidity not working?

SAMPLERS SIGNATURE: Nancy E. Roka / W

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: clear, windy, 10°s | LOCATION ACTIVITY START 1600 END 1715

SITE ID: 57M-95-05X | FIELD SAMPLE NUMBER: MX5705X2 | DATE ~~NR 2/13~~ 2/13/96 | STUDY AREA (AOC): SA 57

WATER LEVEL / WELL DATA

WELL DEPTH 22.3± FT

WATER DEPTH 14.95 FT

HEIGHT OF WATER COLUMN 7.35 FT

☑ x 1.68 gal/ft (4" well) = 12.3 GAL/VOL

☐ x ____ gal/ft (well)

MEASURED FROM

☑ TOP OF WELL

☐ TOP OF CASING

WELL DIAMETER = 4"

PID HEADSPACE READINGS

BREATHING ZONE: bkg ppm

WELL HEAD: bkg ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.5± FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	✓	
WELL LOCKED	✓	
PVC WELL CAP PRESENT	✓	

POTECTIVE CASINGE/WELL DIFFERENCE: -0.43 FT

PURGE DATA

VOLUME #	–	1	2	3	4	5		
GALLONS	0	12	24	36	48	60		
TEMPERATURE, deg. C	8.3	10.1	10.1	9.7	10.2	10.3		
pH units	5.5	5.6	5.5	5.4	5.3	5.5		
SPECIFIC CONDUCTIVITY, umho/cm	88	82	76	75	77	75		
TURBIDITY' ntu	7	0	0	0	0	0		
REDOX (AT COMPLETION OF PURGING)						240 mV		
D.O. (mg/L)	10.3	9.0	9.4	9.5	10.1	9.4		

SAMPLE OBSERVATION

☑ CLEAR

☐ TURBID

☐ COLORED ____

☐ ODOR

☐ OTHER (SEE NOTES)

SAMPLE PARAMETERS

	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	✓	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	✓	UW19	EC	4C	2- 1L AG	C D
VOC	✓	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	✓	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	✓	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	✓	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	✓	418.1	C	H2SO4 pH<2	1- 1L Poly	M N

CONTROL # 176

☐ IF MS/MSD COLLECTED

☐ IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

☑ ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96)

☐ FLOAT ACTIVATED

☐ OTHER ____

PURGING	SAMPLING	
✓	✓	DEDICATED SUBMIRSABLE PUMP (WHALE)
	✓	DEDICATED TEFLON BAILER
	✓	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge H2O headspace = bkg

SAMPLERS SIGNATURE: Nancy E. Roka / SM

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Partly cloudy, 30's | LOCATION ACTIVITY: START 1035 END 1130

SITE ID: 57M-95-06X | FIELD SAMPLE NUMBER: MX5706X2 | DATE: 15 FEB 96 | STUDY AREA (AOC): SA 57

WATER LEVEL / WELL DATA		MEASURED FROM	PID HEADSPACE READINGS		WELL INTEGRITY	YES	NO
WELL DEPTH	24.3± FT	☑ TOP OF WELL	BREATHING ZONE	bkg ppm	PROTECTIVE CASING SECURE	✓	
WATER DEPTH	12.79 FT	☐ TOP OF CASING	WELL HEAD	bkg ppm	WELL LOCKED	✓	
HEIGHT OF WATER COLUMN	11.51 FT	WELL DIAMETER = 4"			PVC WELL CAP PRESENT	✓	

☑ x 1.68 gal/ft (4" well) = 19.3 GAL/VOL
☐ x ____ gal/ft (well)

PROTECTIVE CASING STICK-UP FROM GROUND: 2.0± FT

POTECTIVE CASINGE/WELL DIFFERENCE: -0.19 FT

PURGE DATA	VOLUME #	—	1	2	3	4	5		
	GALLONS	0	19	33	57	76	~~98~~ 95		
TEMPERATURE, deg. C		10.0°	9.6°	9.3°	9.3°	9.1°	9.2°		
pH units		~~4.72~~	4.49	4.44	4.44	4.47	4.51		
SPECIFIC CONDUCTIVITY, umho/cm		.044	.044	.043	.043	.043	.044		
TURBIDITY' ntu		0	0	0	0	0	0		
REDOX (AT COMPLETION OF PURGING)			200						

SAMPLE OBSERVATION: ☑ CLEAR ☐ TURBID ☐ COLORED ____ ☐ ODOR ☐ OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	✓	UM18	MS	4C	2- 1L AG	A B CONTROL # 178
PEST./PCBS	✓	UW19	EC	4C	2- 1L AG	C D
VOC	✓	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	✓	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	✓	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	✓	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	✓	418.1	C	H2SO4 pH<2	1- 1L Poly	M N

☐ IF MS/MSD COLLECTED
☐ IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:
- ☑ ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96)
- ☐ FLOAT ACTIVATED
- ☐ OTHER ____

	PURGING	SAMPLING
DEDICATED SUBMIRSABLE PUMP (WHALE)	✓	✓
DEDICATED TEFLON BAILER		✓
IN-LINE FILTER (INORGANICS)		✓
OTHER ____		

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge H_2O headspace = 0 ppm

SAMPLERS SIGNATURE [signature]

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: 20°s, snow | LOCATION ACTIVITY: START 1545 END 17:00

SITE ID: 57M-95-07X | FIELD SAMPLE NUMBER: MX5707X2 | DATE: 2/14/96 | STUDY AREA (AOC): SA 57

WATER LEVEL / WELL DATA

WELL DEPTH: 14.4± FT

WATER DEPTH: 3.02 FT

HEIGHT OF WATER COLUMN: 11.38 FT

[x] x 1.68 gal/ft (4" well) = 19.1 GAL/VOL

[ ] x ____ gal/ft (well)

MEASURED FROM: [x] TOP OF WELL [ ] TOP OF CASING

WELL DIAMETER = 4"

PID HEADSPACE READINGS

BREATHING ZONE: bkg ppm

WELL HEAD: bkg ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 1.1± FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	✓	
WELL LOCKED	✓	
PVC WELL CAP PRESENT	✓	

POTECTIVE CASINGE/WELL DIFFERENCE: -0.34 FT

PURGE DATA VOLUME #	—	1	2	3	4	5		
GALLONS	0	19	33	57	76	95		
TEMPERATURE, deg. C (see field book)	6.2	7.9	8.1	7.1	8.1	8.1		
pH units (calibration of Horiba may be faulty)	4.98	4.82(1)	4.83	4.78	4.72	4.75*		
SPECIFIC CONDUCTIVITY, umho/cm	50	60	88	69	66	66		
TURBIDITY' ntu	0.52	0.21	0.15	0.15	0.18	0.15		
REDOX (AT COMPLETION OF PURGING)						224 mV		
D.O	6.56	5.96	6.49	6.64	6.04	6.13		

SAMPLE OBSERVATION

[x] CLEAR
[ ] TURBID
[ ] COLORED
[ ] ODOR
[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	✓	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	✓	UW19	EC	4C	2- 1L AG	C D
VOC	✓	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	✓	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	✓	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	✓	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	✓	418.1	C	H2SO4 pH<2	1- 1L Poly	M N

CONTROL # ____

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

[x] ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96)
[ ] FLOAT ACTIVATED
[ ] OTHER ____

PURGING	SAMPLING	
✓	✓	DEDICATED SUBMIRSABLE PUMP (WHALE)
	✓	DEDICATED TEFLON BAILER
	✓	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: ____

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge H2O headspace =

SAMPLERS SIGNATURE: Nancy E. Roka / JJ

(1) 6.46 by Orion SA210

*6.36 " " " "

(EN)VIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Cloudy, 30s | LOCATION ACTIVITY: START 0905 END 1300

SITE ID: 57M-95-08A | FIELD SAMPLE NUMBER: MX5708A2 | DATE: 2/15/96 | STUDY AREA (AOC): SA 57

WATER LEVEL / WELL DATA

WELL DEPTH: 14.3± FT

WATER DEPTH: 2.63 FT

HEIGHT OF WATER COLUMN: 11.67 FT

MEASURED FROM: [✓] TOP OF WELL [ ] TOP OF CASING

WELL DIAMETER = 4"

[✓] x 1.68 gal/ft (4" well) = 19.6 GAL/VOL

[ ] x ____ gal/ft (well)

PID HEADSPACE READINGS

BREATHING ZONE: bkg ppm

WELL HEAD: bkg ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 1.1± FT

WELL INTEGRITY (YES / NO)

PROTECTIVE CASING SECURE: YES ✓

WELL LOCKED: YES ✓

PVC WELL CAP PRESENT: YES ✓

POTECTIVE CASINGE/WELL DIFFERENCE: -0.23 FT

PURGE DATA								
VOLUME #	—	1	2	3	4	5		
GALLONS	0	20	40	60	80	100		
TEMPERATURE, deg. C	~~7.5~~ 6.4	7.5	7.1	7.8	7.8	7.7		
pH units	~~2.64~~ 5.4~~2~~	5.62	5.6	5.65	5.63	5.60		
SPECIFIC CONDUCTIVITY, umho/cm	82	72	72	74	72	69		
TURBIDITY' ntu	190	107	23.9	7.66	6.31	1.30		
REDOX (AT COMPLETION OF PURGING)			165mV					
D.O. (mg/L)	~~7.7~~ 3.2	4.2	6.17	6.74	6.17	5.83		

SAMPLE OBSERVATION

[X] CLEAR by 5th volume

[ ] TURBID

[ ] COLORED ____

[ ] ODOR

[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	1- 1L Poly	M N

CONTROL # 182

[ ] IF MS/MSD COLLECTED

[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

[✓] ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96)

[ ] FLOAT ACTIVATED

[ ] OTHER ____

PURGING	SAMPLING	
✓	✓	DEDICATED SUBMIRSABLE PUMP (WHALE)
	✓	DEDICATED TEFLON BAILER
	✓	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge H_2O headspace = 0.0 ppm

SAMPLERS SIGNATURE: RD [signature]

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Cloudy, 30s | LOCATION ACTIVITY: START 8:50 END 11:55

SITE ID: 57M-95-08B | FIELD SAMPLE NUMBER: MX5708B2 | DATE: 2/15/96 | STUDY AREA (AOC): SA 57

WATER LEVEL / WELL DATA

WELL DEPTH: 30.2± FT

WATER DEPTH: 3.36 FT

HEIGHT OF WATER COLUMN: 26.84 FT

MEASURED FROM: [x] TOP OF WELL [ ] TOP OF CASING

WELL DIAMETER = 4"

[x] x 1.68 gal/ft (4" well) = 45.1 GAL/VOL
[ ] x ___ gal/ft (well)

PID HEADSPACE READINGS

BREATHING ZONE: bkg ppm

WELL HEAD: bkg ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.5± FT

WELL INTEGRITY

	YES	NO
PROTECTIVE CASING SECURE	✓	
WELL LOCKED	✓	
PVC WELL CAP PRESENT	✓	

POTECTIVE CASINGE/WELL DIFFERENCE: -0.50 FT

PURGE DATA

VOLUME #	-	1	2	3	4	5		
GALLONS	0	45	90	135	180	225		
TEMPERATURE, deg. C	7.5	9.3	9.7	9.9	9.7	9.9		
pH units	21.4	5.7	5.64	5.52	5.64	5.62		
SPECIFIC CONDUCTIVITY, umho/cm	55	241	235	236	234	233		
TURBIDITY' ntu	0.23	0.11	0.13	0.15	0.18	0.20		
REDOX (AT COMPLETION OF PURGING)		204						
D.O. (mg/L)	7.7	6.4	6.90	6.5	6.32	6.83		

SAMPLE OBSERVATION

[x] CLEAR
[ ] TURBID
[ ] COLORED ____
[ ] ODOR
[ ] OTHER (SEE NOTES)

SAMPLE PARAMETERS

SAMPLE PARAMETERS	COLLECTED	METHOD #	FRACTION CODE	PRESERVATIVE	VOLUME	SAMPLE BOTTLE NUMBER
SVOCS	X	UM18	MS	4C	2- 1L AG	A B CONTROL # ____
PEST./PCBS	X	UW19	EC	4C	2- 1L AG	C D
VOC	X	UM20	VP	HCL,4C	4- 40 ml AG	E F G H
INORGANICS-UNFILTERED	X	*	N	HNO3 pH<2	1- 1L Poly	I
INORGANICS-FILTERED	X	*	NF	HNO3 pH<2	1- 1L Poly	J
WATER QUALITY PARAM. / TDS	X	* 160.1	C	4C	1- 1L Poly	K
			S	H2SO4 pH<2	1- 1L Poly	L
TPHC	X	418.1	C	H2SO4 pH<2	1- 1L ~~Poly~~ AG glass	M N

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:
[x] ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96)
[ ] FLOAT ACTIVATED
[ ] OTHER ____

PURGING	SAMPLING	
✓	✓	DEDICATED SUBMIRSABLE PUMP (WHALE)
	✓	DEDICATED TEFLON BAILER
	✓	IN-LINE FILTER (INORGANICS)
		OTHER ____

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge H2O head space = 0.0 ppm

SAMPLERS SIGNATURE: Sarah J. Montgomery

GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens
Study Area: SA 57
Project Number: 9144.02
Date: 2/13/96
Sample Location ID: G3M ~~32M~~-92-07X
Time: Start: 0815 End: 1045
Signature of Sampler: MR/SM

Water Level/Well Data

Well Depth 43.5 Ft. ✓ Measured ___ Historical
✓ Top of Well
___ Top of Protective Casing
Well Riser Stick-up 1.88 Ft. (from ground)
Protective Casing/Well Difference -0.22 Ft.
Protective Casing 2.1± Ft.

Depth to Water 26.34 Ft.
Well Material: ✓ PVC ___ SS
Well Locked?: ✓ Yes ___ No
Well Dia. ___ 2 inch ✓ 4 inch ___ 6 inch
Water Level Equip. Used: (taken 2/12/96) ✓ Elect. Cond. Probe ___ Float Activated ___ Press. Transducer

Height of Water Column 17.16 Ft. X ___ .16 Gal/Ft. (2 in.) ___ .65 Gal/Ft. (4 in.) ___ 1.5 Gal/Ft. (6 in.) ___ 1.6 Gal/Ft. (4 in.) = 28.8 Gal/Vol; 145 Total Gal Purged

Well Integrity:	Yes	No
Prot. Casing Secure	✓	
Concrete Collar Intact	✓	
Other		

Equipment Documentation

Purging/Sampling Equipment Used:

(✓ If Used For)

Purging	Sampling		Equipment ID
		Peristaltic Pump	
		Submersible Pump	
	✓	Bailer	
		PVC/Silicon Tubing	
		Teflon/Silicon Tubing	
		Airlift	
		Hand Pump	
	✓	In-line Filter	
		Press/Vac Filter	
✓	✓	whale pump	

Decontamination Fluids Used:

(✓ All That Apply at Location)
___ Methanol (100%)
___ 25% Methanol/75% ASTM Type II water
___ Deionized Water
___ Liquinox Solution
___ Hexane
✓ HNO_3/D.I. Water Solution
✓ Potable Water
___ None

Field Analysis Data

Ambient Air VOC bkg ppm Well Mouth bkg ppm Field Data Collected ___ In-line ___ In Container
Sample Observations: ___ Turbid ✓ Clear ___ Cloudy ___ Colored ___ Odor

Purge Data	@ 0 Gal.	@ 29 Gal.	@ 58 Gal.	@ 87 Gal.	@ 116 Gal.	145
Temperature, Deg. C	8.4	12.3	12.0	11.8	12.2	12.5
pH, units	5.5	5.6	5.3	5.7	5.6	5.6
Specific Conductivity (umhos/cm. @ 25 Deg. C.)	120	270	262	264	256	274
Oxidation - Reduction, +/- mv						215
Dissolved Oxygen, ppm	9.31	3.3	3.5	3.5	3.6	3.4
turbidity (ntu's)	0	0	0	0	0	0

Sample Collection Requirements

(✓ If Required at this Location)

Sample Bottle IDs 166

Analytical Parameter	✓ If Field Filtered	Preservation Method	Volume Required	✓ If Sample Collected	Sample Bottle IDs
VOA		HCL	4040 ml	✓	E / F / G / H
SVOA		4OC	2- liter AG	✓	A / B / /
Pest/PCB		4OC	1-1 liter AG	✓	C / D / /
Inorganics	✓	HNO_3	3- 1 liter P	✓	I / J(NF) / /
Explosives		4°C	2- 1 liter AG		/ / /
TPH		H_2SO_4	2- 1 liter AG	✓	M / N / /
TOC		H_2SO_4	1- 2 liter P		/ / /
Nitrate		H_2SO_4	1- 2 liter P		/ / /

Notes: ✓ H_2O qual. K L

92021590 (j)

ABB Environmental Services, Inc.

Purge H_2O Headspace = bkg

PROJECT: USAEC - FT. DEVENS

SITE ID: 57M-96-09X

FIELD SAMPLE NUMBER: MX5709X1

SITE TYPE: WELL

JOB NUMBER: 9144-08

STUDY AREA/AOC: AOC 57

SAMPLING DATE: ~~9/30/96~~ 10/1/96

FILE TYPE: CGW

WEATHER: Sunny High 60s

LOCATION ACTIVITY: START 11:05 END 11:07

WATER LEVEL / WELL DATA

WELL DEPTH: 25.75 FT — [x] MEASURED [ ] HISTORICAL

WATER DEPTH: 17.82 FT

HEIGHT OF WATER COLUMN: 7.93 FT

[ ] TOP OF WELL [x] TOP OF CASING PVC

PROTECTIVE CASING STICK-UP (FROM GROUND): ___ FT

PROTECTIVE CASING/WELL DIFF.: ___ FT

NA GAL/VOL

15 TOTAL GAL PURGED

[x] 1.68 gal/ft (4")
[ ] ___ gal/ft

1/2 well screen: 21.78 ft

WELL INTEGRITY: (YES / NO / N/A)
- PROT. CASING SECURE: YES
- CONCRETE COLLAR INTACT: YES
- WELL LOCKED: YES
- PVC WELL CAP: YES

WELL DIAMETER: [x] 2 INCH [ ] 4 INCH [ ] ___ INCH

PID READINGS: AMBIENT AIR 0 PPM; WELL MOUTH 0 PPM

started purging 15:05
Started sampling 15:52

PURGE DATA

~~VOLUME #~~ Time	15:12	15:15	15:25	15:30	15:34	15:40	15:43	15:50
water level	17.92	17.92	17.92	17.92	17.92	17.92	17.92	17.92
GALLONS	2	4	5	6	6.5	9	13	15
PUMPING RATE ~~(GPM)~~ mL/min	500	500	500	500	500	500	500	500
TEMP, DEG C	13.6	13.2	13.2	13.1	13.1	13.2	13.0	12.9
pH, UNITS [ ] pH PAPER	5.61	5.59	5.56	5.82	5.80	5.65	5.55	5.51
SPECIFIC CONDUCTIVITY, umhos/cm	0.058	0.058	0.059	0.059	0.058	0.059	0.059	0.058
TURBIDITY, ntu	9	2	0	0	0	0	0	0
REDOX ~~(@ COMPLETION OF PURGING)~~	312	348 mv	348	349	358	376	378	382
	9.06	9.27	7.81	7.76	7.93	7.59	7.78	8.03

final water level 17.86

SAMPLE OBSERVATIONS 16:35
- [x] CLEAR
- [ ] CLOUDY
- [ ] COLORED ___
- [ ] TURBID
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING		
[ ]	[ ]	PERISTALTIC PUMP	ISCO # ___
[x]	[x]	DEDICATED SUBMERSIBLE PUMP	[ ] 2" [ ] 4" # ___
[ ]	[ ]	BAILER	
[x]	[x]	PVC/SILICON TUBING	
	[x]	IN-LINE/DISPOSABLE FILTER 0.45 µm	
[ ]	[ ]	OTHER ___	

EQUIPMENT ID

DECON FLUIDS USED:
- [x] POTABLE WATER
- [x] LIQUINOX
- [ ] STEAM CLEANING

NUMBER OF FILTERS USED ___

WATER LEVEL EQUIP. USED:
- [x] ELECTRIC COND. PROBE
- [ ] PRESSURE TRANSDUCER

ANALYTICAL PARAMETERS

ANALYTICAL PARAMETERS	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS BOTTLE
						REFER TO SAMPLE MGMNT SYSTEM
[ ] VOC	UM20	VP	HCL, 4 DEG C	(4) 60 ML	[ ]	
[ ] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[ ]	
[ ] PEST/PCBs	UH02	EC	4 DEG C	(3) 1 L AG	[ ]	
	UH13					
[ ] PAL INORGANICS (see notes)		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	
[ ] LEAD ONLY	SD20	N	HNO3 TO pH<2		[ ]	
[ ] EXPLOSIVES	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	
	UW32					
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L AG	[ ]	
[ ] ANIONS	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[ ]	
[ ] TSS ONLY	160.2	C	4 DEG C	1 L P-CUBE	[ ]	
[ ] H20 QUALITY (see notes)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	
		C	4 DEG C	1 L P-CUBE	[ ]	
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	
[ ] COLIFORM	303, 909		4 DEG C	(1) 4 OZ STERILE	[ ]	

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H20 QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: P. BYRNES
RECEIVED BY: R. RUSTAD

Note: very fine sand visible in pump tubing

PROJECT	USAEC - FT. DEVENS	FIELD SAMPLE NUMBER	MX5703X3
SITE ID	57M-95-03X	STUDY AREA/AOC	10/2/96
		SITE TYPE	WELL
		SAMPLING DATE	~~9/30/96~~
		JOB NUMBER	09144-03
		FILE TYPE	CGW
LOCATION ACTIVITY	START 11:16 END 11:13	WEATHER	

WATER LEVEL / WELL DATA

WELL DEPTH 19.55 FT ☐ MEASURED ☐ HISTORICAL

WATER DEPTH 10.72 FT

☐ TOP OF WELL ☒ TOP OF CASING ☐ PVC

PROTECTIVE CASING STICK-UP (FROM GROUND) ____ FT

PROTECTIVE CASING/WELL DIFF. ____ FT

HEIGHT OF WATER COLUMN 8.83 FT

GAL/VOL ____ TOTAL GAL PURGED ____

WELL INTEGRITY: YES NO N/A
PROT. CASING SECURE ☐ ☐ ☐
CONCRETE COLLAR INTACT ☐ ☐ ☐
WELL LOCKED ☐ ☐ ☐
PVC WELL CAP ☐ ☐ ☐

WELL DIAMETER ☐ 2 INCH ☐ 4 INCH ☐ ___ INCH

started purging 14:16
started sampling 15:00
Sample headspace = 9.8 ppm

☐ 1.68 gal/ft (4")
☐ ___ gal/ft

PID READINGS: AMBIENT AIR 0.3 PPM WELL MOUTH 0.0 PPM

mid screen = 15.1 ft

finished sampling 15:53
final water level = 10.95

PURGE DATA								
~~VOLUME #~~ TIME	14:26	14:35	14:42	14:45	14:48	14:54	14:57	15:04
water level	10.98	10.98	11.12	11.08	11.04	11.04	11.04	11.07
GALLONS	0.1	0.3	1.0	1.2	1.4	1.6	1.8	2.2
PUMPING RATE (GPM)	500	300	500	350	400	400	400	400
TEMP, DEG C	15.9	15.5	15.5	15.3	15.3	15.4	15.4	15.4
pH, UNITS ☐ pH PAPER	5.07	5.04	5.10	5.18	5.22	5.25	5.26	5.30
SPECIFIC CONDUCTIVITY, umhos/cm	0.061	0.060	0.062	0.069	0.071	0.070	0.071	0.072
TURBIDITY, ntu	9	7	2	0	0	0	0	0
REDOX (~~@ COMPLETION OF PURGING~~) +/- mv	253	252	251	251	251	251	251	251
DO (10%)	1.53	0.88	0.53	0.30	0.27	0.24	0.24	0.24

SAMPLE OBSERVATIONS
☐ CLEAR
☐ CLOUDY
☐ COLORED ________
☐ TURBID
☐ ODOR
☐ OTHER (SEE NOTES)

5 gal. of purge water discharged to drum.

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING		EQUIPMENT ID
☐	☐	PERISTALTIC PUMP	ISCO # ____
☐	☐	DEDICATED SUBMERSIBLE PUMP	
☐	☐	BAILER	☐ 2" ☐ 4" # ____
☐	☐	PVC/SILICON TUBING	
	☐	IN-LINE/DISPOSABLE FILTER ____	
☐	☐	OTHER ____	

DECON FLUIDS USED
☐ POTABLE WATER
☐ LIQUINOX
☐ STEAM CLEANING
☐ ____

WATER LEVEL EQUIP. USED
☐ ELECTRIC COND. PROBE
☐ PRESSURE TRANSDUCER
____

NUMBER OF FILTERS USED ____

ANALYTICAL PARAMETERS	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS BOTTLE
☐ VOC	UM20	VP	HCL, 4 DEG C	(4) 60 ML	☐	___/___/___/___
☐ SVOC	UM18	MS	4 DEG C	(2) 1 L AG	☐	___/___/___/___
☐ PEST/PCBs	UH02	EC	4 DEG C	(3) 1 L AG	☐	___/___/___/___
	UH13					
☐ PAL INORGANICS (see notes)		N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/___
☐ LEAD ONLY	SD20	N	HNO3 TO pH<2		☐	___/___/___/___
☐ EXPLOSIVES	UW19	LC	4 DEG C	(3) 1 L AG	☐	___/___/___/___
	UW32					
☐ TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	☐	___/___/___/___
☐ TOC	415.1	O	H2SO4 TO pH<2	1 L AG	☐	___/___/___/___
☐ ANIONS	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	☐	___/___/___/___
	TT10	C	4 DEG C	1 L P-CUBE	☐	___/___/___/___
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/___
☐ TSS ONLY	160.2	C	4 DEG C	1 L P-CUBE	☐	___/___/___/___
☐ H2O QUALITY (see notes)		S	H2SO4 TO pH<2	1 L P-CUBE	☐	___/___/___/___
		C	4 DEG C	1 L P-CUBE	☐	___/___/___/___
		N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/___
☐ COLIFORM	303, 909		4 DEG C	(1) 4 OZ STERILE	☐	___/___/___/___

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: P. [signature]
RECEIVED BY: ____

PROJECT	USAEC - FT. DEVENS	FIELD SAMPLE NUMBER	MX57/0X/
SITE ID	57M-96-10X	STUDY AREA/AOC	AOC 57
		SITE TYPE	WELL
		SAMPLING DATE	9/30/96 10/2/96
		JOB NUMBER	09144-08
		FILE TYPE	CGW
LOCATION ACTIVITY	10/2/96 9:12 START 11:16 END 11:17	WEATHER	

WATER LEVEL / WELL DATA

WELL DEPTH 15.54 FT ☐ MEASURED ☐ HISTORICAL

WATER DEPTH 6.62 FT

HEIGHT OF WATER COLUMN 8.92 FT

☐ TOP OF WELL ☐ TOP OF CASING ☐ ______

PROTECTIVE CASING STICK-UP (FROM GROUND) ______ FT

PROTECTIVE CASING/WELL DIFF. ______ FT

______ GAL/VOL

4.2 TOTAL GAL PURGED

☐ 1.68 gal/ft (4") 4.46

☐ ____ gal/ft

WELL INTEGRITY:	YES	NO	N/A
PROT. CASING SECURE	☐	☐	☐
CONCRETE COLLAR INTACT	☐	☐	☐
WELL LOCKED	☐	☐	☐
PVC WELL CAP	☐	☐	☐

WELL DIAMETER ☒ 2 INCH ☐ 4 INCH ☐ __ INCH

PID READINGS: AMBIENT AIR ______ PPM WELL MOUTH ______ PPM

Start Level 6.76	7.04	7.07	7.12	7.08	7.10	7.12	7.04	7.05	7.07
PURGE DATA Time ~~VOLUME~~ #	925	930	935	940	945	9:50	9:55	10:00	10:05
GALLONS	1	1.2	1.6	1.8	2.0	2.2	2.4	2.6	2.7
50 ml/m PUMPING RATE (GPM)	50 ml/m	50 ml/m	50 ml/m	50 ml/m	50 ml/m	50 ml/m	50 ml/m	50 ml/m	50 ml/m
TEMP, DEG C	13.3	13.3	13.3	13.3	13.3	13.3	13.4	13.4	13.4
pH, UNITS ☐ pH PAPER	4.42	4.37	4.43	4.50	4.56	4.80	4.98	5.08	4.95
SPECIFIC CONDUCTIVITY, umhos/cm	.024	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
TURBIDITY, ntu	0	0	0	0	0	0	0	0	0
REDOX (~~@ COMPLETION OF PURGING~~):	226	321	321	332	322	321	322	322	321
D.O	-0.08	-0.27	-0.20	-0.15	0.26	-0.15	-0.23	0.22	-0.22

SAMPLE OBSERVATIONS

☐ CLEAR
☐ CLOUDY
☐ COLORED ______
☐ TURBID
☐ ODOR
☐ OTHER (SEE NOTES)

Sample Time 10:06

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING		EQUIPMENT ID
☐	☐	PERISTALTIC PUMP	ISCO # ______
☐	☐	DEDICATED SUBMERSIBLE PUMP	
☐	☐	BAILER	☐ 2" ☐ 4" # ___
☐	☐	PVC/SILICON TUBING	
	☐	IN-LINE/DISPOSABLE FILTER ______	
☐	☐	OTHER ______	

DECON FLUIDS USED: ☐ POTABLE WATER ☐ LIQUINOX ☐ STEAM CLEANING ☐ ______

WATER LEVEL EQUIP. USED: ☐ ELECTRIC COND. PROBE ☐ PRESSURE TRANSDUCER ☐ ______

NUMBER OF FILTERS USED ______

ANALYTICAL PARAMETERS	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS	BOTTLE
☐ VOC	UM20	VP	HCL, 4 DEG C	(4) 60 ML	☐	___/___/___/___	
☐ SVOC	UM18	MS	4 DEG C	(2) 1 L AG	☐	___/___/___/___	
☐ PEST/PCBs	UH02	EC	4 DEG C	(3) 1 L AG	☐	___/___/___/___	
	UH13						
☐ PAL INORGANICS (see notes)		N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/___	
☐ LEAD ONLY	SD20	N	HNO3 TO pH<2		☐	___/___/___/___	
☐ EXPLOSIVES	UW19	LC	4 DEG C	(3) 1 L AG	☐	___/___/___/___	
	UW32						
☐ TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	☐	___/___/___/___	
☐ TOC	415.1	O	H2SO4 TO pH<2	1 L AG	☐	___/___/___/___	
☐ ANIONS	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	☐	___/___/___/___	
	TT10	C	4 DEG C	1 L P-CUBE	☐	___/___/___/___	
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/___	
☐ TSS ONLY	160.2	C	4 DEG C	1 L P-CUBE	☐	___/___/___/___	
☐ H2O QUALITY (see notes)		S	H2SO4 TO pH<2	1 L P-CUBE	☐	___/___/___/___	
		C	4 DEG C	1 L P-CUBE	☐	___/___/___/___	
		N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/___	
☐ COLIFORM	303, 909		4 DEG C	(1) 4 OZ STERILE	☐	___/___/___/___	

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: ______________

RECEIVED BY: ______________

PROJECT: USAEC - FT. DEVENS

FIELD SAMPLE NUMBER: MX5711X1

STUDY AREA/AOC: [illegible] 10/2/96

SITE ID: 57M-96-11X

SITE TYPE: WELL

SAMPLING DATE: 9/30/96

JOB NUMBER: 09144-08

FILE TYPE: CGW

LOCATION ACTIVITY: START 11:18 END 11:20

WEATHER:

WATER LEVEL / WELL DATA

☐ TOP OF WELL
☒ TOP OF CASING PVC
☐

PROTECTIVE CASING STICK-UP (FROM GROUND): FT

PROTECTIVE CASING/WELL DIFF.: FT

WELL DEPTH: 14.62 FT ☐ MEASURED ☐ HISTORICAL

WATER DEPTH: 3.42 FT 3.51 [illegible] 10/2/96

GAL/VOL

HEIGHT OF WATER COLUMN: ~~11.11~~ 11.2 FT

4.5 TOTAL GAL PURGED

WELL INTEGRITY: YES NO N/A
PROT. CASING SECURE ☐ ☐ ☐
CONCRETE COLLAR INTACT ☐ ☐ ☐
WELL LOCKED ☐ ☐ ☐
PVC WELL CAP ☐ ☐ ☐

WELL DIAMETER: ☒ 2 INCH ☐ 4 INCH ☐ ___ INCH

Completed Sampling 12:46

☐ 1.68 gal/ft (4") ½ = 5.6
☐ ___ gal/ft

PID READINGS: AMBIENT AIR 000.3 PPM ~~WELL MOUTH~~ 0.8 PPM

began purging 10:35

began sampling. 11:45

drop pump to 9.0 ft

PURGE DATA

starting H2O level 3.51

PURGE DATA											
time (~~VOLUME #~~)	10:45	10:53	10:58	11:02	11:12	11:16	11:22	11:25	11:38	11:41	11:44
water level	4.00	4.04	4.02	4.02	4.02	4.06	4.14	4.10	4.00	4.00	4.00
GALLONS	0.3	0.5	0.6	0.7	0.8	0.9	1.2	1.5	1.6	1.65	1.75
PUMPING RATE ml/min (~~GPM~~)	200	200	150	150	150	150	150	150	150	150	150
TEMP, DEG C	13.2	13.1	13.2	13.2	13.2	13.2	13.1	13.1	13.4	13.4	13.4
pH, UNITS ☐ pH PAPER	6.03	6.08	6.09	6.10	6.09	6.09	6.10	6.10	6.10	6.10	6.10
SPECIFIC CONDUCTIVITY, umhos/cm	0.147	0.149	0.148	0.147	0.147	0.146	0.146	0.147	0.145	0.145	0.146
TURBIDITY, ntu	3	2	0	0	0	0	0	0	0	0	0
REDOX (~~@ COMPLETION OF PURGING~~): +/- mv	253	251	250	247	244	244	242	241	244	243	244
DO	0.34	0.34	0.27	0.26	0.22	0.18	0.17	0.10	0.09	0.10	0.10

3.70

4.5

SAMPLE OBSERVATIONS
☐ CLEAR
☐ CLOUDY
☐ COLORED
☐ TURBID
☐ ODOR
☐ OTHER (SEE NOTES)

EQUIPMENT DOCUMENTATION

PURGING SAMPLING

☐ ☐ PERISTALTIC PUMP — EQUIPMENT ID: ISCO #___
☐ ☐ DEDICATED SUBMERSIBLE PUMP
☐ ☐ BAILER ☐ 2" ☐ 4" #___
☐ ☐ PVC/SILICON TUBING
☐ ☐ IN-LINE/DISPOSABLE FILTER___
☐ ☐ OTHER___

DECON FLUIDS USED
☐ POTABLE WATER
☐ LIQUINOX
☐ STEAM CLEANING
☐ ___

NUMBER OF FILTERS USED ___

WATER LEVEL EQUIP. USED
☐ ELECTRIC COND. PROBE
☐ PRESSURE TRANSDUCER
☐ ___

ANALYTICAL PARAMETERS

ANALYTICAL PARAMETERS	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS BOTTLE
☐ VOC	UM20	VP	HCL, 4 DEG C	(4) 60 ML	☐	___/___/___/___
☐ SVOC	UM18	MS	4 DEG C	(2) 1 L AG	☐	___/___/___/___
☐ PEST/PCBs	UH02	EC	4 DEG C	(3) 1 L AG	☐	___/___/___/___
	UH13					
☐ PAL INORGANICS (see notes)		N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/___
☐ LEAD ONLY	SD20	N	HNO3 TO pH<2		☐	___/___/___/___
☐ EXPLOSIVES	UW19	LC	4 DEG C	(3) 1 L AG	☐	___/___/___/___
	UW32					
☐ TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	☐	___/___/___/___
☐ TOC	415.1	O	H2SO4 TO pH<2	1 L AG	☐	___/___/___/___
☐ ANIONS	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	☐	___/___/___/___
	TT10	C	4 DEG C	1 L P-CUBE	☐	___/___/___/___
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/___
☐ TSS ONLY	160.2	C	4 DEG C	1 L P-CUBE	☐	___/___/___/___
☐ H2O QUALITY (see notes)		S	H2SO4 TO pH<2	1 L P-CUBE	☐	___/___/___/___
		C	4 DEG C	1 L P-CUBE	☐	___/___/___/___
		N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/___
☐ COLIFORM	303, 909		4 DEG C	(1) 4 OZ STERILE	☐	___/___/___/___

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: RB

RECEIVED BY:

PROJECT: USAEC - FT. DEVENS

FIELD SAMPLE NUMBER: M X 5 7 1 Z X 1

STUDY AREA/AOC: AOC 57

SITE ID: 57M-96-12X

SITE TYPE: WELL

SAMPLING DATE: 9/30/96 10/2/9

JOB NUMBER: 09144.08

FILE TYPE: CGW

10/2/96 1115

LOCATION ACTIVITY: START 11:22 END 11:24

WEATHER: Sunny Low 60s

WATER LEVEL / WELL DATA

WELL DEPTH: 15.15 FT

WATER DEPTH: 4.98 FT

☒ MEASURED ☐ HISTORICAL

☐ TOP OF WELL ☒ TOP OF CASING PVC

PROTECTIVE CASING STICK-UP (FROM GROUND): ___ FT

PROTECTIVE CASING/WELL DIFF.: ___ FT

GAL/VOL: ___

TOTAL GAL PURGED: 8

HEIGHT OF WATER COLUMN: 10.17 FT

☐ 1.68 gal/ft (4") (5.08)

☐ 0.9 gal/ft

WELL INTEGRITY: YES NO N/A

- PROT. CASING SECURE: ☒ YES
- CONCRETE COLLAR INTACT: ☒ YES
- WELL LOCKED: ☒ YES
- PVC WELL CAP: ☒ YES

WELL DIAMETER: ☒ 2 INCH ☐ 4 INCH ☐ ___ INCH

PID READINGS: AMBIENT AIR 0 PPM; WELL MOUTH 0 PPM

Start level 11:15 4.89

PURGE DATA										
(water level)		5.96	6.04	6.05	6.05	6.04	6.12	6.12	6.10	
Time	1150	1155	1200	1205	1210	1215	1218	1221	1224	1227
GALLONS	1	2.2	2.3	2.4	2.5	3.0	3.3	3.4	3.5	3.8
PUMPING RATE (GPM)	50 ml/m	50 ml/m	750 ml/m	750 ml/m	750 ml/m	750 ml/m	750 ml/m	750 ml/m	750 ml/m	750 ml/m
TEMP, DEG C	14.0	13.8	13.6	13.6	13.5	13.5	13.5	13.4	13.4	13.4
pH, UNITS ☐ pH PAPER	5.15	5.12	5.09	5.13	5.10	5.12	5.12	5.14	5.15	5.15
SPECIFIC CONDUCTIVITY, umhos/cm	0.78	0.77	0.71	0.74	0.72	0.72	0.74	0.74	0.75	0.75
TURBIDITY, ntu	87	98	258	320	390	310	252	287	295	244
REDOX (~~@ COMPLETION OF PURGING~~):	230	215	211	198	187	201	214	214	205	200
D.O	1.35	0.69	1.03	0.69	0.67	0.18	0.18	0.29	0.26	0.

SAMPLE OBSERVATIONS: ☐ CLEAR ☐ CLOUDY ☐ COLORED ☐ TURBID ☐ ODOR ☐ OTHER (SEE NOTES)

EQUIPMENT DOCUMENTATION

PURGING / SAMPLING

- ☐ ☐ PERISTALTIC PUMP — EQUIPMENT ID: ISCO #___
- ☐ ☐ DEDICATED SUBMERSIBLE PUMP ☐ 2" ☐ 4" #___
- ☐ ☐ BAILER
- ☐ ☐ PVC/SILICON TUBING
- ☐ ☐ IN-LINE/DISPOSABLE FILTER___
- ☐ ☐ OTHER___

DECON FLUIDS USED: ☒ POTABLE WATER ☐ LIQUINOX ☐ STEAM CLEANING ☐ ___

WATER LEVEL EQUIP. USED: ☒ ELECTRIC COND. PROBE ☐ PRESSURE TRANSDUCER ☐ ___

NUMBER OF FILTERS USED: 1

Sample Time 1230

ANALYTICAL PARAMETERS	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS	BOTTLE
☐ VOC	UM20	VP	HCL, 4 DEG C	(4) 60 ML	☐		
☐ SVOC	UM18	MS	4 DEG C	(2) 1 L AG	☐		
☐ PEST/PCBs	UH02	EC	4 DEG C	(3) 1 L AG	☐		
	UH13						
☐ PAL INORGANICS (see notes)		N	HNO3 TO pH<2	1 L P-CUBE	☐		
☐ LEAD ONLY	SD20	N	HNO3 TO pH<2		☐		
☐ EXPLOSIVES	UW19	LC	4 DEG C	(3) 1 L AG	☐		
	UW32						
☐ TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	☐		
☐ TOC	415.1	O	H2SO4 TO pH<2	1 L AG	☐		
☐ ANIONS	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	☐		
	TT10	C	4 DEG C	1 L P-CUBE	☐		
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	☐		
☐ TSS ONLY	160.2	C	4 DEG C	1 L P-CUBE	☐		
☐ H2O QUALITY (see notes)		S	H2SO4 TO pH<2	1 L P-CUBE	☐		
		C	4 DEG C	1 L P-CUBE	☐		
		N	HNO3 TO pH<2	1 L P-CUBE	☐		
☐ COLIFORM	303, 909		4 DEG C	(1) 4 OZ STERILE	☐		

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: ___

RECEIVED BY: ___

PROJECT	USAEC - FT. DEVENS	FIELD SAMPLE NUMBER	MX5713X1	STUDY AREA/AOC	10/2/96
SITE ID	57M-96-13X	SITE TYPE	WELL	SAMPLING DATE	~~9/30/96~~
		JOB NUMBER	09144-08	FILE TYPE	CGW
LOCATION ACTIVITY	START 11:26 END 11:29			WEATHER	

WATER LEVEL / WELL DATA

WELL DEPTH 15.12 FT ☒ MEASURED ☐ HISTORICAL

☐ TOP OF WELL ☒ TOP OF CASING PVC

PROTECTIVE CASING STICK-UP (FROM GROUND) ______ FT

PROTECTIVE CASING/WELL DIFF. ______ FT

WATER DEPTH 4.96 FT

NA GAL/VOL

TOTAL GAL PURGED

HEIGHT OF WATER COLUMN 10.16 FT

WELL INTEGRITY:	YES	NO	N/A
PROT. CASING SECURE	☐	☐	☐
CONCRETE COLLAR INTACT	☐	☐	☐
WELL LOCKED	☐	☐	☐
PVC WELL CAP	☐	☐	☐

WELL DIAMETER ☒ 2 INCH ☐ 4 INCH ☐ ___ INCH

☐ 1.68 gal/ft (4") 5.08

☐ ___ gal/ft 4.82

PID READINGS: AMBIENT AIR ______ PPM WELL MOUTH ______ PPM

Starting level 4.96 ms

		5.40	5.36	5.45	5.43	5.39	5.44	5.45	5.49
PURGE DATA Time ~~VOLUME #~~	2:30	235	240	245	250	255	300	3:05	3:10
GALLONS	0.5	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
PUMPING RATE (GPM)	Trickle	<50 ml/m	<50 ml/m	<50 ml/m	<50 ml/m	<50	<50	<50	<50
TEMP, DEG C	14.7	14.6	14.3	14.2	14.2	14.2	14.1	14.1	14.0
pH, UNITS ☐ pH PAPER	5.68	5.63	5.59	5.57	5.58	5.58	5.61	5.64	5.67
SPECIFIC CONDUCTIVITY, umhos/cm	.110	.110	.110	.111	.112	.112	.112	.111	.111
TURBIDITY, ntu	4	0	0	0	0	0	0	0	0
REDOX ~~(@ COMPLETION OF PURGING)~~:	136	105 mv	100	64	53	65	45	~~254~~ 43	48
D.O.	0.48	0.63	0.82	0.89	0.83	0.74	0.81	0.75	0.79

SAMPLE OBSERVATIONS

- ☐ CLEAR
- ☐ CLOUDY
- ☐ COLORED ______
- ☐ TURBID
- ☐ ODOR
- ☐ OTHER (SEE NOTES)

Rate: 250 ml/5 min

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING		EQUIPMENT ID
☐	☐	PERISTALTIC PUMP	ISCO # ______
☐	☐	DEDICATED SUBMERSIBLE PUMP	
☐	☐	BAILER	☐ 2" ☐ 4" # ___
☐	☐	PVC/SILICON TUBING	
	☐	IN-LINE/DISPOSABLE FILTER ______	
☐	☐	OTHER ______	

DECON FLUIDS USED

- ☐ POTABLE WATER
- ☐ LIQUINOX
- ☐ STEAM CLEANING
- ☐ ______

WATER LEVEL EQUIP. USED

- ☐ ELECTRIC COND. PROBE
- ☐ PRESSURE TRANSDUCER
- ☐ ______

Sample Time 3:10

NUMBER OF FILTERS USED ______

ANALYTICAL PARAMETERS	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS	BOTTLE
☐ VOC	UM20	VP	HCL, 4 DEG C	(4) 60 ML	☐	___/___/___/	___
☐ SVOC	UM18	MS	4 DEG C	(2) 1 L AG	☐	___/___/___/	___
☐ PEST/PCBs	UH02	EC	4 DEG C	(3) 1 L AG	☐	___/___/___/	___
	UH13						
☐ PAL INORGANICS (see notes)		N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/	___
☐ LEAD ONLY	SD20	N	HNO3 TO pH<2		☐	___/___/___/	___
☐ EXPLOSIVES	UW19	LC	4 DEG C	(3) 1 L AG	☐	___/___/___/	___
	UW32						
☐ TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	☐	___/___/___/	___
☐ TOC	415.1	O	H2SO4 TO pH<2	1 L AG	☐	___/___/___/	___
☐ ANIONS	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	☐	___/___/___/	___
	TT10	C	4 DEG C	1 L P-CUBE	☐	___/___/___/	___
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/	___
☐ TSS ONLY	160.2	C	4 DEG C	1 L P-CUBE	☐	___/___/___/	___
☐ H2O QUALITY (see notes)		S	H2SO4 TO pH<2	1 L P-CUBE	☐	___/___/___/	___
		C	4 DEG C	1 L P-CUBE	☐	___/___/___/	___
		N	HNO3 TO pH<2	1 L P-CUBE	☐	___/___/___/	___
☐ COLIFORM	303, 909		4 DEG C	(1) 4 OZ STERILE	☐	___/___/___/	___

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H20 QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: ______

RECEIVED BY: ______

PROJECT	USAEC - FT. DEVENS	FIELD SAMPLE NUMBER	MXG307X3	STUDY AREA/AOC	AOC 57
SITE ID	G3M-92-07X	SITE TYPE	WELL	SAMPLING DATE	9/30/96
10/1 2:42		JOB NUMBER	9144-08	FILE TYPE	CGW
LOCATION ACTIVITY	START 10:58 END 11:02			WEATHER	Sunny High 40s

WATER LEVEL / WELL DATA

WELL DEPTH 34.29 FT ☐ MEASURED ☐ HISTORICAL

☐ TOP OF WELL ☒ TOP OF ✓CASING ☐ PVC

PROTECTIVE CASING STICK-UP (FROM GROUND) ____ FT

PROTECTIVE CASING/WELL DIFF. ____ FT

WATER DEPTH 25.92 FT

HEIGHT OF WATER COLUMN 8.37 FT

NA GAL/VOL

9¢ TOTAL GAL PURGED

☑ 1.68 gal/ft (4")
☐ ____ gal/ft

WELL INTEGRITY:	YES	NO	N/A
PROT. CASING SECURE	☑	☐	☐
CONCRETE COLLAR INTACT	☑	☐	☐
WELL LOCKED	☑	☐	☐
PVC WELL CAP	☑	☐	☐

WELL DIAMETER ☐ 2 INCH ☑ 4 INCH ☐ ____ INCH

345 348

PID READINGS: AMBIENT AIR 0 PPM WELL MOUTH 0 PPM

25.96 25.96 25.97 25.97

PURGE DATA								
Time ~~VOLUME #~~	325	~~3~~	~~3~~	351	354			
GALLONS	1	3	4	4.5	5			
PUMPING RATE (GPM)	300 ml/m	500 ml/m	500 ml/m	500 ml/m				
TEMP, DEG C	15.3	14.9	14.7	14.6	14.4			
pH, UNITS ☐ pH PAPER	6.04	6.03	6.01	6.01	6.01			
SPECIFIC CONDUCTIVITY, umhos/cm	.308	.338	.343	.349	.350			
TURBIDITY, ntu	0	0	0	0	0			
REDOX (@ COMPLETION OF PURGING):	110	175 mv	195	205	207			
D.O	6.07	7.09	7.22	7.26	7.30			

SAMPLE OBSERVATIONS

☑ CLEAR
☐ CLOUDY
☐ COLORED ____
☐ TURBID
☐ ODOR
☐ OTHER (SEE NOTES)

3:55 (1555) Sample Time

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING		EQUIPMENT ID
☑	☑	PERISTALTIC PUMP	ISCO # ____
☐	☐	DEDICATED SUBMERSIBLE PUMP	☐ 2" ☐ 4" # ____
☐	☐	BAILER	
☑	☑	PVC/SILICON TUBING	
	☑	IN-LINE/DISPOSABLE FILTER	0.45 um
☐	☐	OTHER ____	

DECON FLUIDS USED
☑ POTABLE WATER
☐ LIQUINOX
☐ STEAM CLEANING
☐ ____

WATER LEVEL EQUIP. USED
☑ ELECTRIC COND. PROBE
☐ PRESSURE TRANSDUCER
☐ ____

NUMBER OF FILTERS USED 1

ANALYTICAL PARAMETERS	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS BOTTLE
						REFER TO SAMP MGMNT SYSTEM
☐ VOC	UM20	VP	HCL, 4 DEG C	(4) 60 ML	☐	
☐ SVOC	UM18	MS	4 DEG C	(2) 1 L AG	☐	
☐ PEST/PCBs	UH02	EC	4 DEG C	(3) 1 L AG	☐	
	UH13					
☐ PAL INORGANICS (see notes)		M	HNO3 TO pH<2	1 L P-CUBE	☐	
☐ LEAD ONLY	SD20	M	HNO3 TO pH<2		☐	
☐ EXPLOSIVES	UW19	LC	4 DEG C	(3) 1 L AG	☐	
	UW32					
☐ TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	☐	
☐ TOC	415.1	O	H2SO4 TO pH<2	1 L AG	☐	
☐ ANIONS	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	☐	
	TT10	C	4 DEG C	1 L P-CUBE	☐	
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	☐	
☐ TSS ONLY	160.2	C	4 DEG C	1 L P-CUBE	☐	
☐ H2O QUALITY (see notes)		S	H2SO4 TO pH<2	1 L P-CUBE	☐	
		C	4 DEG C	1 L P-CUBE	☐	
		N	HNO3 TO pH<2	1 L P-CUBE	☐	
☐ COLIFORM	303, 909		4 DEG C	(1) 4 OZ STERILE	☐	

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: M Rooney

RECEIVED BY: R. Rustad

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57S-98-01X
Time: Start: 0855 End: 0915

Site: AOC 57 Area 2
Date: 5/19/98
Signature of Sampler: Nancy E. Roka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

≥ at ~1 ft bgs

Equipment Used For Collection:
[✓] Hand Auger
[✓] S.S. Split Spoon (deep only) NC
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor
[ ] Color
[ ]

Soil Type:
[ ] Clay
[ ] Sand
[✓] Organic
[ ] Gravel
[✓] silt

Sample Location Sketch:
[ ] Yes
[✓] No See map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	/ / /
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	/ / /
[✓] Pest/PCB	LH16	SS			[✓]	/ / /
	LH10				[ ]	/ / /
[✓] PAL Inorganics	See Below	SS			[✓]	/ / /
[ ] Explosives	LW12	SS			[ ]	/ / /
[✓] TPHC	418.1	SS			[✓]	/ / /
[ ] Lead Only	JD17	SS			[ ]	/ / /
NC [✓] TOC	415.1	SS	↓		[ ]	/ / /
[ ] TCLP	1311	SS		4 DEG C + methanol	[✓]	/ / /
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

	Samp ID	Time	Depth	PID	Descrip.
field screening samples	SF570100	0900	0-6" bgs	1.0 (momentary)	silt + org, drk l
	SF570101	0910 NC	1-1.5' bgs	0.3	sand, silt, + org. med brown wet

Collected confirmatory sample at SF570101 (SX570101)

HLADVISK1 = QST lab ID

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 2

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57S-98-02X
Time: Start: 1035 End: 1050
Site: AOC 57 Area 2
Date: 5/19/98
Signature of Sampler: Nancy E. Roka

SOIL SAMPLE

Field Sample No. see below

Depth of Sample see below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

$\underline{\nabla}$ = ~ 1 ft bgs (+ rising ?)

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (shallow ~~deep~~ only) NR

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	___/___/___/___
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS	↓		[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[✓] TCLP	1311	SS		4 DEG C/methanol	[✓]	___/___/___/___
[✓] EPH/VPH			(1) 16 OZ AG		~~[✓]~~ NR	

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	(bgs) Depth	(ppm) PID	Obs.
SF570200	1040	0-0.5'	8.5 (briefly)	sandy silt, org., med brown
SF570201	1045	1-~~1.5~~ 2	0.3	[1-1.5 " " , high org. / 1.5-2 light br. sand + silt]

Off-site sample collected ~~for~~ at NR 0-0.5' bgs
(QST lab # HLADV15X2)
SX570200

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 575-98-03X
Time: Start: 1115 End: 1140
Site: AOC 57 Area 2
Date: 5/19/98
Signature of Sampler: Nancy E. Rotka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

$\underline{\nabla}$ = ~1.5' bgo

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[✓] Odor petroleum
[ ] Color ______
[ ] ______

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	___/___/___/___
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS	↓		[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[ ] TCLP	1311	SS		4 DEG C/MeOH	[✓]	___/___/___/___
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	(ft bgs) Depth	(ppm) PID	Obs.
SF570300	1120	0-0.5'	0.3	sandy silt, little org., med brown
SF570302	1130	2-2.5'	1.3	drk brown sandy silt w/ org (woody)

Off-site sample (SX570302) collected from 2-2.5 ft. bgo (petr. odor).
QST lab # = HLADVIS*3

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: DEVENS
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: ~~NS~~ 57S-98-04X
Time: Start: ~~1200~~ 1150 End: 1200
Signature of Sampler: Nancy E. Rofka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

$\underline{\nabla} \simeq 1$ ft. bgs

Equipment Used For Collection:
[✓] Hand Auger deep only
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Soil Type:
[ ] ~~Clay~~
[✓] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] ~~Yes~~
[✓] No see map

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	/ / /
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	/ / /
[✓] Pest/PCB	LH16	SS	↓		[✓]	/ / /
	LH10				[ ]	/ / /
[✓] PAL Inorganics	See Below	SS			[✓]	/ / /
[ ] Explosives	LW12	SS			[ ]	/ / /
[✓] TPHC	418.1	SS			[✓]	/ / /
[ ] Lead Only	JD17	SS			[ ]	/ / /
[ ] TOC	415.1	SS			[ ]	/ / /
[ ] TCLP	1311	SS		4 DEG C / MeOH	[✓]	/ / /
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft. bgs)	(ppm) PID	Obs.
SF5704~~00~~ 01	1155	0-~~.5~~ 0.5	0.3	poorly gr. sand
SF570401	1200	1-1.5	0.3	poorly gr. sand

(SX570401)
Off-site sample / collected from 1-1.5 ft bgs.
QST lab # HLADVIS * 4

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 2

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: ~~SX~~ 57S-98-05X
Time: Start: 1355 End: 1410

Site: AOC 57 Area 2
Date: ~~4/~~ 5/19/98
Signature of Sampler: Nancy E. Roka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

$\underline{\nabla}$ = 3.5-4 (moist)

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	/ / /
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	/ / /
[✓] Pest/PCB	LH16	SS	↓		[✓]	/ / /
	LH10				[ ]	/ / /
[✓] PAL Inorganics	See Below	SS			[✓]	/ / /
[ ] Explosives	LW12	SS			[ ]	/ / /
[✓] TPHC	418.1	SS			[✓]	/ / /
[ ] Lead Only	JD17	SS			[ ]	/ / /
[ ] TOC	415.1	SS			[ ]	/ / /
[ ] TCLP	1311	SS		4 DEG C/MeOH	[✓]	/ / /
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft. bgs)	PID (ppm)	Obs.
NR S~~X~~F570500	1355	0-0.5	–	well ~~graded~~ ~~sorted~~ sand STET
S~~X~~F570503 NR	1410	3-4.5	0.3	well graded sand (fine to course) rocky fill from 0.5-3 ft bgs)

Off-site sample (SX570503) NR collected ~~for~~ from 2-2.5 ft bgs.

QST lab # = HLADVIS*5

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 2

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57S-98-06X
Time: Start: 0950 End: 1010

Site: AOC 57 Area 2
Date: 5/19/98
Signature of Sampler: Nancy E Roka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

V ~ 6" bgs

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	___/___/___/___
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS	↓		[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[ ] TCLP	1311	SS		4 DEG C + methanol	[✓]	___/___/___/___
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth	PID	Obs.
SF570600	0955	0-6"	1 ppm	Org. roots + some silt
SF570601	1010	1-1.5'	1.7 ppm (7.5 ppm momentarily)	sand, silt, + org. wet
Hole			~20 ppm	

* Collected off-site sample from 1-1.5' bgs
(QST lab # HLADVIS*8)
SX570601

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 2

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57S-98-07X
Time: Start: 1425 End: 1500

Site: AOC 57 Area 2
Date: 5/19/98
Signature of Sampler: Nancy E. Roka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [✓] Field Duplicate Collected
Duplicate ID SD570700
(QST lab. # HLADVIS*27)

⊻ = 1 ft. bgs

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (shallow & deep)

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	___/___/___/___
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS	↓		[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[ ] TCLP	1311	SS		4 DEG C/MeOH	[✓]	___/___/___/___
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft. bgs)	PID (ppm)	Obs.
(MS) ~~SX~~ 570700	1430	0-0.5	7.5	drk br. org. and silt
(MS) ~~SX~~ F 570701	1500	1-1.5	~28 (Hot + Sunny)	organic silt, black wet

- Off-site sample collected at SX570700 (0-0.5 ft bgs).
- QST lab # = HLADVIS*7
- Off-site sample collected at SX570701 (1-1.5 ft bgs)

QST lab # = HLADVIS*8

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens　　Site: AOC 57 Area 2
Project Number: 09144.08　　Date: 5/19/98
Site Identification: (NR) ~~SX570800~~ 57S-98-08X
Time: Start: 1545　End: ______　　Signature of Sampler: Nancy E. Rotka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

¥ = ~ 0.5 ft bgs

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (shallow only)

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	/ / /
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	/ / /
[✓] Pest/PCB	LH16	SS	↓		[✓]	/ / /
	LH10				[ ]	/ / /
[✓] PAL Inorganics	See Below	SS			[✓]	/ / /
[ ] Explosives	LW12	SS			[ ]	/ / /
[✓] TPHC	418.1	SS			[✓]	/ / /
[ ] Lead Only	JD17	SS			[ ]	/ / /
[ ] TOC	415.1	SS			[ ]	/ / /
[ ] TCLP	1311	SS		4 DEG C/MeOH	[✓]	/ / /
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft. bgs)	PID (ppm)	Obs.
(NR) F SX570800	1550	0-0.5	17	Dry brown org. + silt (moist)
SX570801 (NR) F	1600	1-1.5	0.8	same, w/ sand at ~1.5 ft bgs (moist)

off-site sample collected at SX570800 (0-0.5' bgs).

QST lab # = HLADVIS*9

- Dense root mat

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: 57S-98-09X
Time: Start: 1600 End: 1625
Signature of Sampler: Nancy E. Rota

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ____

▽ = 1 ft. bgs

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (shallow only)

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor ____
[ ] Color ____
[ ] ____

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	___/___/___/___
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS	↓		[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[ ] TCLP	1311	SS		4 DEG C/MeOH	[✓]	___/___/___/___
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft. bgs)	PID (ppm)	Obs
NR F SX570900	1605	0-0.5	9.4	
SX570901 NR F	1620	1-2	0.8	Black org. ind. lain by brown f sand

Off-site sample collected at SX570900 (0-0.5 ft bgs)

QST lab # = HLADVIS*10

* Dense root mat (~4" thick) overlying pockets of H_2O (i.e., spongy stepping)

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 575-98-10X
Time: Start: 1630 End: 1645
Site: AOC 57 Area 2
Date: 5/19/98
Signature of Sampler: Nancy E. Pota

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

$\underline{\nabla}$ = 0.5 ft bgs

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[ ] ______

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓] e	___/___/___/___
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS	↓		[✓]	___/___/___/___
	LH10				[ ] NR	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[ ] TCLP	1311	SS		4 DEG C/MeOH	[✓]	___/___/___/___
[✓] VPH/EPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NR e

No off-site samples collected at 575-98-10X

NOTES/SKETCH

Samp ID	Time	Depth (ft bgs)	PID* (ppm)	Obs.
~~SX~~ 571000 NR	1635	0-0.5	0.3	Black silt & org.
~~SX~~ 571001 NR F	1640	1-2	0.3	Black silt & org w/ sand at ~1 ft bgs (somewhat gravelly)

* Dense root mat (~4" thick) overlying pockets of H_2O (i.e., spongy stepping)

* PID malfunctioning (reading 13 ppm ~~ino~~ NR in ambient air.)

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: (NR) 8 57S-98-11X
Time: Start: 1015 End: 1025
Site: AOC 57 Area 3
Date: 5/20/98
Signature of Sampler: Nancy E. Pokc

SOIL SAMPLE

Field Sample No. see below

Depth of Sample see below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[ ] ______

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see below

$\underline{\nabla}$ = ~3 ft. bgs
(see note below)

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

SAMPLES COLLECTED

(NR)
No off-site sample collected

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[ ]	_/_/_/_
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[ ]	_/_/_/_
[✓] Pest/PCB	LH16	SS	↓		[ ]	_/_/_/_
	LH10				[ ]	_/_/_/_
[✓] PAL Inorganics	See Below	SS			[ ]	_/_/_/_
[ ] Explosives	LW12	SS			[ ]	_/_/_/_
[✓] TPHC	418.1	SS			[ ]	_/_/_/_
[ ] Lead Only	JD17	SS			[ ]	_/_/_/_
[ ] TOC	415.1	SS			[ ]	_/_/_/_
[ ] TCLP	1311	SS		4 DEG C/MeOH	[ ]	_/_/_/_
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft bgs)	Obs.
SF571100	1020	0-0.5	black, org., sandy silt
SF571103	1025	3-3.5	sand, wet, poorly graded firm, light brown

* PID not working. Judged off-site samp. locations by look, odor, + historical info.

$\underline{\nabla}$ in MW-12 is ~2 ft. bgs (~15' N of 57S-98-11)

No offsite sample

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57S-98-12X
Time: Start: 1030 End: 1040
Site: AOC 57 Area 3
Date: 5/20/98
Signature of Sampler: Nancy E. Roka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ____________

$\underline{\nabla}$ = ~1 ft. bgs

Equipment Used For Collection:
[✓] Hand Auger (deep)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[ ] ____________

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor ____________
[ ] Color ____________
[ ] ____________

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[ ] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[ ]	___/___/___/___
[ ] SVOC	LM18	SS	(1) 16 OZ AG		[ ]	___/___/___/___
[ ] Pest/PCB	LH16	SS	↓		[ ]	___/___/___/___
	LH10				[ ]	___/___/___/___
[ ] PAL Inorganics	See Below	SS			[ ]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[ ] TPHC	418.1	SS			[ ]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[ ] TCLP	1311	SS	(1) 16 OZ AG	4 DEG C	[ ]	___/___/___/___

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft bgs)	Obs.
SF571200	1035	0-0.5	black, org. silt - root mat
SF571201	1040	1-1.5	sand, wet, poorly graded f-m, light brown

* PID not working - off-site sample loc.s chosen by sight, odor, & historical info.

No off-site sample collected

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57S-98-13X
Time: Start: 1045 End: 1055
Site: AOC 57 Area 3
Date: 5/20/98
Signature of Sampler: Nancy E. Roka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ____________

∇ = ~ 0.5 ft. bgs

Equipment Used For Collection:
[✓] Hand Auger (deep)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[✓] Odor petroleum
[ ] Color ____________
[ ] ____________

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	___/___/___/___
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS	↓		[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[ ] TCLP	1311	SS		4 DEG C/MeOH	[ ]	___/___/___/___
[✓] VPH/EPH			(1) 16 OZ AG		[✓]	

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft. bgs)	Obs.
SF571300	1050	0-0.5	drk br. org. + sandy silt moist
SF571301	1055	1-1.5	brown and reddish / orange wet sand + interlayered w/ black silt + peat - petroleum odor

* PID not working. - off-site sample loc.s chosen by sight, odor, + historical info.
Off-site sample collected at SX571301 (1-1.5 ft. bgs)
QST lab # = HLADV1S*11

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
—ABB Environmental Services, Inc.—

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 575-98-14X
Time: Start: 1110 End: 1120

Site: AOC 57 Area 3
Date: 5/20/98
Signature of Sampler: Nancy E. Roka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

$\underline{\nabla}$ = 1 ft. bgs

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	___/___/___/___
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS			[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS	↓		[ ]	___/___/___/___
[ ] TCLP	1311	SS		4 DEG C/MeOH	[✓]	___/___/___/___
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft. bgs)	Obs.
SF571400	1105	0-0.5	~~org.~~ NR 0.5-1 ft. orange sand black org. layer on top (0-0.5 ft)
SF571401	1120	1-~~1.5~~ 3 NR	2 ft. orangish-grey sand wet - poorly gr. fine

- No ~~peat~~ root NR layer on surface - dense root layer at ~ 6" bgs.

* PID not working - off-site samples chosen by sight, odor, + historical info.

Off-site sample collected at SX571401 (1-~~1.5~~ 3 ft bgs), including an NR MS/MSD

- QST lab # = HLADVIS*12

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/20/98
Site Identification: 57S-98-15X
Time: Start: 1140 End: 1150
Signature of Sampler: Nancy E. Roka

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

$\underline{\nabla}$ = 3 ft. bgo

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[✓]	___/___/___/___
[✓] SVOC	LM18	SS	(1) 16 OZ AG		[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS	↓		[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[ ] TCLP	1311	SS		4 DEG C/MeOH	[✓]	___/___/___/___
[✓] EPH/VPH			(1) 16 OZ AG			

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft bgs)	obs
SF571500	1145	0-0.5	black org. sandy silt - dense tree root layer at 6"
SF571503	1150	3-~~3.5~~+ (NR)	orange f-m poorly gr. Sand - wet

* PID not working - off-site samples chosen by sight, odor, + historical info.

Off-site sample collected at SX571503 (3-3.5ft bgs).

QST lab # = HLADVIS*13

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57S-98-16S
Time: Start: 1155 End: 1205

Site: AOC 57 Area 3
Date: 5/20/98
Signature of Sampler: Nancy E. Rolea

SOIL SAMPLE

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

$\underline{\nabla}$ = ~~1/2~~ 1.5 ft bgs

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[ ] ______

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

SAMPLES COLLECTED

Analysis	Method Number	Fraction Code	Volume Required	Preservation Method	Sample Collected	Sample Bottle ID Numbers
[ ] VOC	LM19	SV	(2) 2OZ AG	4 DEG C	[ ]	___/___/___/___
[ ] SVOC	LM18	SS	(1) 16 OZ AG		[ ]	___/___/___/___
[ ] Pest/PCB	LH16	SS	↓		[ ]	___/___/___/___
	LH10				[ ]	___/___/___/___
[ ] PAL Inorganics	See Below	SS			[ ]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[ ] TPHC	418.1	SS			[ ]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[ ] TOC	415.1	SS			[ ]	___/___/___/___
[ ] TCLP	1311	SS	(1) 16 OZ AG	4 DEG C	[ ]	___/___/___/___

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NOTES/SKETCH

Samp ID	Time	Depth (ft. bgs)	Obs.
SF571600	1200	0-0.5	- black org. sandy silt (erosional sand at surf.) tree root layer at 0.5 ft bgs
SF571602	1205	2-2.5	- orange mod. graded sand - wet

* PID not working - chose off-site samples based on sight, odor, + historical info.

No off-site sample collected

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 2

SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens Site: AOC 57
Project Number: 09144.08 Date: 5/20/98
Site Identification: SBK-98-01X
Time: Start: 0835 End: 0845 Signature of Sampler: ______

SURFACE WATER INFORMATION

Field Sample No. SBK9801X Water Depth NA (ft)

Depth of Sample From Top of Water NA (ft) Temperature NA Deg. C.

Spec. Cond. NA µMHOS/CM PpH NA Units

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [ ] Seep

Sample Location Sketch: [ ] Yes
[ ] No

Equipment Used For Collection:
[ ] None, Grab Into Bottle
[ ] Bomb Sampler
[ ] Pump ______

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record ______

SEDIMENT INFORMATION

Field Sample No. ______

Depth of Sediment Sample ______ (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id ______

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[ ] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[ ] ______

Type Of Sample Collected:
[ ] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

SAMPLES COLLECTED

Analysis	Method Number	Faction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	UM20	VP	HCL, 4 DEG C	(4) 40 ML	[ ]	__/__/__/__
[✓] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[ ]	__/__/__/__
[✓] Pest/PCB	UH02	EC	4 DEG C	(2) 1 L AG	[ ]	__/__/__/__
	UH13					__/__/__/__
[✓] PAL Inorganics (Specified Below) Un-Filtered		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
[ ] Lead Only	SD20	N	HNO3 TO pH<2		[ ]	__/__/__/__
[ ] Explosives	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	__/__/__/__
	UW32					__/__/__/__
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	__/__/__/__
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
[ ] Anions	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	__/__/__/__
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
[ ] TSS Only	160.2	C	4 DEG C	1 L P-CUBE	[ ]	__/__/__/__
[ ] H2O Quality (Specified Below)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
		C	4 DEG C	1 L P-CUBE	[ ]	__/__/__/__
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
[ ] Coliform	303,909		4 DEG C	(1) 4 OZ Sterile	[ ]	__/__/__/__
[✓] EPH/VPH			HCl / H_2SO_4 / 4 Deg C (VPH / EPH)		[ ]	__/__/__/__

Analysis	Method Number	Fraction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[ ] VOC	LM19	SV	4 DEG C	(2) 2OZ AG	[ ]	__/__/__/__
[ ] SVOC	LM18	SS		(1) 16 OZ AG	[ ]	__/__/__/__
[ ] Pest/PCB	LH16	SS			[ ]	__/__/__/__
	LH10				[ ]	__/__/__/__
[ ] PAL Inorganics	See Below	SS			[ ]	__/__/__/__
[ ] Explosives	LW12	SS			[ ]	__/__/__/__
[ ] TPHC	418.1	SS			[ ]	__/__/__/__
[ ] Lead Only	JD17	SS			[ ]	__/__/__/__
[ ] TOC	415.1	SS			[ ]	__/__/__/__
[ ] TCLP	1311	SS	4 DEG C	(1) 16 OZ AG	[ ]	__/__/__/__

NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/S04 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

Rinseate blank to represent decon procedures after Soil ~~sediment~~ sampling ~~to~~ (MR) at Area 2.
(MR)
Equipment: soil auger, SS bowl, SS spoon
(MR) ~~D~~ H2O source: H2O point decon H2O

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	USAEC / Devens AOC 57	FIELD SAMPLE NUMBER	MX5702XX	STUDY AREA / AOC	AOC 57
SITE ID	57P-98-02X	SITE TYPE	WELL	DATE	5-26-98
ACTIVITY	START 1500 END ~~1430~~ 1730 (RR)	JOB NUMBER	09144-08	FILE TYPE	CGW
				WEATHER	CLOUDY/60'S

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH 4.35 FT (TOR) HISTORICAL WELL DEPTH 4.35 FT (TOR) PROTECTIVE CASING STICKUP (FROM GROUND) (TOC) 2.05 FT PROTECTIVE CASING / WELL DIFFERENCE NA FT

DEPTH TO WATER 3.2 FT (TOR) SCREEN LENGTH 2 FT WELL DIAMETER 1 IN WELL MATERIAL PVC SCH 40

HEIGHT OF WATER COLUMN 1.15 FT x ___ GAL/FT (___ INCH WELL) = ___ GAL/VOL

PID AMBIENT AIR BKG PPM PID WELL MOUTH BKG PPM TOTAL VOLUME PURGED ___ GAL

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING			✓
COLLAR			✓
LOCKED			✓

PURGE DATA

PURGE VOLUME (gallons)	0.25	0.75	1.5			
PURGE RATE (gpm)						
TEMPERATURE (degreesC)	16.3	14.2	14.1			
pH (units)	5.9	6.1	6.1			
~~TURBIDITY (ntu)~~ D.O.	5.3↓	3.2↓	2.8↓			
SPEC. COND. (uhmos/cm)	0.135	0.95	0.90			
TURBIDITY (ntu)	999	438	380			
REDOX POTENTIAL (+/- mv)						

SAMPLE OBSERVATIONS:
- [ ] CLEAR
- [x] COLORED GREY
- [ ] CLOUDY
- [x] TURBID
- [x] ODOR SWAMPY
- [ ] OTHER (see notes)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING	
✓	✓	PERISTALTIC PUMP
		SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
	✓	IN LINE FILTER

DECON FLUIDS USED
- [ ] METHANOL
- [ ] LIQUINOX
- [x] POTABLE WATER
- [ ] DEIONIZED WATER
- [ ] STEAM CLEANING
- [ ] NITRIC ACID

WATER LEVEL EQUIPMENT USED
- [x] ELECTRIC COND. PROBE
- [ ] FLOAT ACTIVATED
- [ ] KECK INTERFACE PROBE

NUMBER OF FILTERS USED 1

ANALYTICAL PARAMETERS

EPH/VPH

	PARAMETER	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
✓	VOC	VMS3-WA		HCL / 4 DEG. C	3 X 40 ML	✓	/ /
	VOC	VMS1-WA		HCL / 4 DEG. C	3 X 40 ML		/ /
✓	SVOC	SMV1-WA		4 DEG. C	2 X 1 L AG	✓	/ /
	SVOC	SMV3-WA		4 DEG. C	2 X 1 L AG		/ /
✓	PEST / PCBs	PST1-WA		4 DEG. C	2 X 1 L AG	✓	/ /
	HERBICIDES	HB61-WA		4 DEG. C	2 X 1 L AG		/ /
✓	PAL INORGANICS (TOTAL + FILTERED)	(see notes)		HNO3 to pH <2	1 x 1 L P	✓	/ /
	SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
	SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
	IRON ONLY	ICP1-WA		HNO3 to pH <2	1 x 1 L P-Cube		/ /
	FERROUS IRON	FIELD METHOD		--	--		/ /
	TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
	AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
	TOC	USEPA-415.1		H2SO4 to pH <2	1 X 500 ML AG		
	TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
	METHANE / CARBON DIOXIDE						/ /

NOTES

(1) PAL INORGANICS: ICP METALS (ICP1-WA AND ICP2-WA), HG (HGC1-WA)

WELL PURGES DRY AT 1 WELL VOLUME RECHARGE AT A 1/2 LITRE/MIN OR LESS

~~MD5702XX DUPLICATE COLLECTED AS WELL AS MS/MSD FOR EPH/VPH, PEST/PCB, AND INORG.~~ UNABLE TO COLLECT QA/QC DUE TO SMALL WELL VOLUME AND SLOW RECHARGE

SIGNATURE: [signature]

RECEIVED BY: ___

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	USAEC / Devens AOC 57	FIELD SAMPLE NUMBER	MX5703XX	STUDY AREA / AOC	AOC 57
SITE ID	57P-98-03X	SITE TYPE	WELL	DATE	5-26-98
ACTIVITY	START 1745 END 1845	JOB NUMBER	9144-08	FILE TYPE	CGW
				WEATHER	CLEAR 70°

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	6.8 FT (TOR)	HISTORICAL WELL DEPTH	7.5 ~~6.8~~ FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	2.0 FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	2.45 FT (TOR)	SCREEN LENGTH	3.0 FT	WELL DIAMETER	1 IN	WELL MATERIAL	PVC
HEIGHT OF WATER COLUMN	4.4 FT	x ___ GAL/FT (___ INCH WELL) =	GAL/VOL				
PID AMBIENT AIR	BKG PPM	PID WELL MOUTH	BKG PPM	TOTAL VOLUME PURGED	GAL		

WELL INTEGRITY	YES	NO	N/A
CAP	Y		
CASING			✓
COLLAR			✓
LOCKED			✓

PURGE DATA

PURGE VOLUME (gallons)	1 L	3 L	5 L			
PURGE RATE (gpm)	0.25 L/m	250 ml/min				
TEMPERATURE (degreesC)	14.7	14.2	14.1			
pH (units)	6.12	6.6	6.6			
~~TURBIDITY (ntu)~~ D.O.	1.75 ↓	6.1 ↓	5.9			
SPEC. COND. (uhmos/cm)	0.91	.096	0.09			
TURBIDITY (ntu)	999	4	4			
REDOX POTENTIAL (+/- mv)						

SAMPLE OBSERVATIONS:
- [ ] CLEAR
- [ ] COLORED ______
- [ ] CLOUDY ______
- [x] TURBID CLEARING
- [ ] ODOR ______
- [ ] OTHER (see notes)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING	
✓	✓	PERISTALTIC PUMP
		SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
	✓	IN LINE FILTER
		______

DECON FLUIDS USED
- [ ] METHANOL
- [ ] LIQUINOX
- [x] POTABLE WATER
- [ ] DEIONIZED WATER
- [ ] STEAM CLEANING
- [ ] NITRIC ACID
- ______

WATER LEVEL EQUIPMENT USED
- [x] ELECTRIC COND. PROBE
- [ ] FLOAT ACTIVATED
- [ ] KECK INTERFACE PROBE
- [ ] ______

NUMBER OF FILTERS USED ______

ANALYTICAL PARAMETERS

EPH/VPH

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
[x] VOC	VMS3-WA		HCL / 4 DEG. C	3 X 40 ML	[ ]	/ /
[ ] VOC	VMS1-WA		HCL / 4 DEG. C	3 X 40 ML	[ ]	/ /
[x] SVOC	SMV1-WA		4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] SVOC	SMV3-WA		4 DEG. C	2 X 1 L AG	[ ]	/ /
[x] PEST / PCBs	PST1-WA		4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] HERBICIDES	HB61-WA		4 DEG. C	2 X 1 L AG	[ ]	/ /
[x] PAL INORGANICS	(see notes)		HNO3 to pH <2	1 x 1 L P	[ ]	/ /
[ ] SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P	[ ]	/ /
[ ] SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P	[ ]	/ /
[ ] IRON ONLY	ICP1-WA		HNO3 to pH <2	1 x 1 L P-Cube	[ ]	/ /
[ ] FERROUS IRON	FIELD METHOD		--	--	[ ]	/ /
[ ] TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P	[ ]	/ /
[ ] AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P	[ ]	/ /
[ ] TOC	USEPA-415.1		H2SO4 to pH <2	1 X 500 ML AG	[ ]	
[ ] TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P	[ ]	/ /
[ ] METHANE / CARBON DIOXIDE					[ ]	/ /

NOTES

(1) PAL INORGANICS: ICP METALS (ICP1-WA AND ICP2-WA), HG (HGC1-WA)

Low Flow Sample Collection For All Samples

SIGNATURE: ______

RECEIVED BY: ______

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT	USAEC / Devens AOC 57	FIELD SAMPLE NUMBER	MX5704XX	STUDY AREA / AOC	AOC 57
SITE ID	57P-98-04X	SITE TYPE	WELL	DATE	5-27-9
ACTIVITY	START 0735 END 0930	JOB NUMBER	09144-03	FILE TYPE	CGW
				WEATHER	CLEAR 65°

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH	7.5 FT (TOR)	HISTORICAL WELL DEPTH	7.5 FT (TOR)	PROTECTIVE CASING STICKUP (FROM GROUND)	2.5 FT	PROTECTIVE CASING / WELL DIFFERENCE	NA FT
DEPTH TO WATER	2.95 FT (TOR)	SCREEN LENGTH	3 FT	WELL DIAMETER	IN	WELL MATERIAL	PVC
HEIGHT OF WATER COLUMN	4.55 FT	x ___ GAL/FT (___ INCH WELL) =	GAL/VOL				
PID AMBIENT AIR	BKG PPM	PID WELL MOUTH	BKG PPM	TOTAL VOLUME PURGED	GAL		

WELL INTEGRITY	YES	NO	N/A
CAP	✓		
CASING			✓
COLLAR			✓
LOCKED			✓

PURGE DATA

PURGE VOLUME (gallons)	2 L	6 L	8 L			
PURGE RATE (gpm)	500 ml/min	500 ml/min	500 ml/min			
TEMPERATURE (degreesC)	12.0	11.0	10.9			
pH (units)	6.0	6.10	6.12			
TURBIDITY (ntu)	999	25	16			
SPEC. COND. (uhmos/cm)	0.131	0.092	0.089			
~~TURBIDITY (ntu)~~ D.O. (mg/L)	1.6	2.5	3.5			
REDOX POTENTIAL (+/- mv)						

SAMPLE OBSERVATIONS:
- [ ] CLEAR
- [ ] COLORED ______
- [ ] CLOUDY ______
- [x] TURBID CLEARING
- [x] ODOR SWAMPY
- [ ] OTHER (see notes)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING	
✓	✓	PERISTALTIC PUMP
		SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
	✓	IN LINE FILTER
		______

DECON FLUIDS USED
- [ ] METHANOL
- [ ] LIQUINOX
- [x] POTABLE WATER
- [ ] DEIONIZED WATER
- [ ] STEAM CLEANING
- [ ] NITRIC ACID
- ______

WATER LEVEL EQUIPMENT USED
- [x] ELECTRIC COND. PROBE
- [ ] FLOAT ACTIVATED
- [ ] KECK INTERFACE PROBE
- [ ] ______

NUMBER OF FILTERS USED ______

ANALYTICAL PARAMETERS

EPH-VPH

	METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
[x] VOC	VMS3-WA		HCL / 4 DEG. C	3 X 40 ML	[ ]	/ /
[ ] VOC	VMS1-WA		HCL / 4 DEG. C	3 X 40 ML	[ ]	/ /
[x] SVOC	SMV1-WA		4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] SVOC	SMV3-WA		4 DEG. C	2 X 1 L AG	[ ]	/ /
[x] PEST / PCBs	PST1-WA		4 DEG. C	2 X 1 L AG	[ ]	/ /
[ ] HERBICIDES	HB61-WA		4 DEG. C	2 X 1 L AG	[ ]	/ /
[x] PAL INORGANICS	(see notes)		HNO3 to pH <2	1 x 1 L P	[ ]	/ /
[ ] SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P	[ ]	/ /
[ ] SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P	[ ]	/ /
[ ] IRON ONLY	ICP1-WA		HNO3 to pH <2	1 x 1 L P-Cube	[ ]	/ /
[ ] FERROUS IRON	FIELD METHOD		–	–	[ ]	/ /
[ ] TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P	[ ]	/ /
[ ] AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P	[ ]	/ /
[ ] TOC	USEPA-415.1		H2SO4 to pH <2	1 X 500 ML AG	[ ]	
[ ] TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P	[ ]	/ /
[ ] METHANE / CARBON DIOXIDE					[ ]	/ /

NOTES
(1) PAL INORGANICS: ICP METALS (ICP1-WA AND ICP2-WA) , HG (HGC1-WA)

SIGNATURE: ______

RECEIVED BY: ______

FIELD DATA RECORD - GROUNDWATER SAMPLING

PROJECT: USAEC / Devens AOC 57
FIELD SAMPLE NUMBER: MX5711XX
STUDY AREA / AOC: AOC 57
SITE ID: 57M-96-11X
SITE TYPE: WELL
DATE: 05.27.98
ACTIVITY: START 0835 END 0900
JOB NUMBER: 09144-08
FILE TYPE: CGW
WEATHER: CLEAR 65°

WATER LEVEL / WELL DATA

MEASURED WELL DEPTH: 15.10 FT (TOR)
HISTORICAL WELL DEPTH: 15.10 FT (TOR)
PROTECTIVE CASING STICKUP (FROM GROUND): 2.30 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.60 FT

DEPTH TO WATER: 4.05 FT (TOR)
SCREEN LENGTH: 10 FT
WELL DIAMETER: ____ IN
WELL MATERIAL: PVC

HEIGHT OF WATER COLUMN: 11.95 FT x ___ GAL/FT (___ INCH WELL) = ____ GAL/VOL

PID AMBIENT AIR: BKG PPM
PID WELL MOUTH: BKG PPM
TOTAL VOLUME PURGED: ____ GAL

WELL INTEGRITY	YES	NO	N/A
CAP	✓		✓
CASING			✓
COLLAR			✓
LOCKED			✓

PURGE DATA

PURGE VOLUME (gallons)	4L	12L	18L			
PURGE RATE (gpm)	2L/min	2L/min	2L/min			
TEMPERATURE (degreesC)	9.3°	9	8.8°			
pH (units)	6.18	6.23	6.21			
TURBIDITY (ntu)	56	14	9			
SPEC. COND. (uhmos/cm)	0.157	0.145	0.145			
~~TURBIDITY (ntu)~~ DO (mg/L)	1.13	1.84	1.10			
REDOX POTENTIAL (+/- mv)						

SAMPLE OBSERVATIONS:
- [ ] CLEAR
- [x] COLORED Lt. orange/cloudy
- [ ] CLOUDY ____
- [ ] TURBID ____
- [x] ODOR Swampy
- [ ] OTHER (see notes)

EQUIPMENT DOCUMENTATION

PURGING	SAMPLING	
✓	✓	PERISTALTIC PUMP
		SUBMERSIBLE PUMP
		BLADDER PUMP
✓	✓	PVC/SILICON TUBING
		TEFLON/SILICON TUBING
		BAILER
	✓	IN LINE FILTER
		____

DECON FLUIDS USED:
- [ ] METHANOL
- [ ] LIQUINOX
- [x] POTABLE WATER
- [ ] DEIONIZED WATER
- [ ] STEAM CLEANING
- [ ] NITRIC ACID
- [ ] ____

WATER LEVEL EQUIPMENT USED:
- [x] ELECTRIC COND. PROBE
- [ ] FLOAT ACTIVATED
- [ ] KECK INTERFACE PROBE
- [ ] ____

NUMBER OF FILTERS USED ____

ANALYTICAL PARAMETERS

EPH - VPH

		METHOD NUMBER	FRACTION CODE	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	SAMPLE BOTTLE ID NUMBERS
✓	VOC	VMS3-WA		HCL / 4 DEG. C	3 X 40 ML		/ /
	VOC	VMS1-WA		HCL / 4 DEG. C	3 X 40 ML		/ /
✓	SVOC	SMV1-WA		4 DEG. C	2 X 1 L AG		/ /
	SVOC	SMV3-WA		4 DEG. C	2 X 1 L AG		/ /
✓	PEST / PCBs	PST1-WA		4 DEG. C	2 X 1 L AG		/ /
	HERBICIDES	HB61-WA		4 DEG. C	2 X 1 L AG		/ /
✓	PAL INORGANICS	(see notes)		HNO3 to pH <2	1 x 1 L P		/ /
	SULFATE NITRATE/NITRITE	USEPA 300		4 DEG. C	1 X 50 ML P		/ /
	SULFIDE	USEPA 376.1		NAOH to pH >9	1 X 500 ML P		/ /
	IRON ONLY	ICP1-WA		HNO3 to pH <2	1 x 1 L P-Cube		/ /
	FERROUS IRON	FIELD METHOD		--	--		/ /
	TOTAL PHOSPHORUS	USEPA-365.4		H2SO4 to pH <2	1 X 50 ML P		/ /
	AMMONIA NIROGEN	USEPA-350.1		H2SO4 to pH <2	1 X 400 ML P		/ /
	TOC	USEPA-415.1		H2SO4 to pH <2	1 X 500 ML AG		
	TSS ONLY	USEPA-160.2		4 DEG. C	1 X 1 L P		/ /
	METHANE / CARBON DIOXIDE						/ /

NOTES

(1) PAL INORGANICS: ICP METALS (ICP1-WA AND ICP2-WA), HG (HGC1-WA)

Duplicate MD5711XX Collected

MS/MSD Collected

SIGNATURE: ____

RECEIVED BY: ____

SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57W-98-01X/57D-98-01X
Time: Start: 0830 End: 0850
Signature of Sampler: Nancy E. Rofo

SURFACE WATER INFORMATION

Field Sample No. WX570100 Water Depth 1" (ft)

Depth of Sample From Top of Water — (ft) Temperature 11.2 Deg. C.

Spec. Cond. 74 µMHOS/CM pH 5.56 Units

Turb. 999+ ntus

DO 1.41 mg/L

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Type of Surface Water:
[ ] Stream
[ ] River
[ ] Pond/Lake
[✓] Seep
[✓] Marsh

Sample Location Sketch: [ ] Yes [✓] No see map

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

Equipment Used For Collection:
[✓] None, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump/ Si tubing / inline filter
[✓] SS P/C spoon + bowl (to pile from shallow seep)

SEDIMENT INFORMATION

Field Sample No. DX570100

Depth of Sediment Sample 0-4" (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] silt

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor
[ ] Color
[ ]

SAMPLES COLLECTED

Analysis	Method Number	Faction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	UM20	VP	HCL, 4 DEG C	(4) 40 ML	✓	/ / /
[✓] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[✓]	/ / /
[✓] Pest/PCB	UH02	EC	4 DEG C	(2) 1 L AG	[✓]	/ / /
	UH13					/ / /
[✓] PAL Inorganics (Specified Below)		N/NF	HNO3 TO pH<2	1 L P-CUBE	[✓]	/ / /
[ ] Lead Only	SD20	N	HNO3 TO pH<2		[ ]	/ / /
[ ] Explosives	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	/ / /
	UW32					/ / /
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	/ / /
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
[ ] Anions	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	/ / /
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[ ]	/ / /
✓ TSS Only	160.2	C	4 DEG C	1 L P-CUBE	[✓]	/ / /
[ ] H2O Quality (Specified Below)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
		C	4 DEG C	1 L P-CUBE	[ ]	/ / /
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	/ / /
[ ] Coliform	303.909		4 DEG C	(1) 4 OZ Sterile	[ ]	/ / /
[✓] EPH/VPH			HCl/H2SO4/ice (VPH) (EPH)		[✓]	/ / /

Analysis	Method Number	Fraction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	4 DEG C	(2) 2OZ AG	[✓]	/ / /
[✓] SVOC	LM18	SS		(1) 16 OZ AG	[✓]	/ / /
[✓] Pest/PCB	LH16	SS			[✓]	/ / /
	LH10				[✓]	/ / /
[✓] PAL Inorganics	See Below	SS			[✓]	/ / /
[ ] Explosives	LW12	SS			[ ]	/ / /
[✓] TPHC	418.1	SS			[✓]	/ / /
[ ] Lead Only	JD17	SS			[ ]	/ / /
[✓] TOC	415.1	SS			[✓]	/ / /
[ ] TCLP	1311	SS	4 DEG C	(1) 16 OZ AG	[ ]	/ / /
[✓] EPH/VPH			4°C/MeOH		[✓]	

NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

*big "glob" of (~1-2 oz) SD/murky H_2O got in filtered sample

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 3

SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57W-98-02X/57D-98-02X
Time: Start: See below End: 0915
Site: AOC 57 Area 2
Date: 5/21/98
Signature of Sampler: Nancy E Roka

SURFACE WATER INFORMATION

Field Sample No. WX570200 Water Depth 6" (ft)
Depth of Sample From Top of Water 0 (ft) Temperature 13.5 Deg. C.
Spec. Cond. 150 µMHOS/CM pH 6.09 Units
Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [ ] Seep
[✓] Marsh

Sample Location Sketch: [ ] Yes [✓] No see map
Turb. 999+ ntus
DO 0.14 mg/L

Equipment Used For Collection:
[✓] ~~None~~, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump / Si + PVC tubing / inline filter

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record ______

SEDIMENT INFORMATION

Field Sample No. DX570200
Depth of Sediment Sample 1-1 1/3* (ft)
Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id ______

*sed is ~1' under vegetation + H_2O

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[ ] Sand
[✓] Organic (thick tussock sedge + ~~grass~~ cattail growth over SD)
[ ] Gravel
[✓] Silt

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

SAMPLES COLLECTED

Analysis	Method Number	Faction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	UM20	VP	HCL, 4 DEG C	(4) 40 ML	[✓]	__/__/__/__
[✓] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[✓]	__/__/__/__
[✓] Pest/PCB	UH02	EC	4 DEG C	(2) 1 L AG	[✓]	__/__/__/__
	UH13					__/__/__/__
[✓] PAL Inorganics (Specified Below)		N/NF	HNO3 TO pH<2	1 L P-CUBE	[✓]	__/__/__/__
[ ] Lead Only	SD20	N	HNO3 TO pH<2		[ ]	__/__/__/__
[ ] Explosives	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	__/__/__/__
	UW32					__/__/__/__
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	__/__/__/__
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
[ ] Anions	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	__/__/__/__
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[✓]	__/__/__/__
[✓] TSS Only	160.2	C	4 DEG C	1 L P-CUBE	[✓]	__/__/__/__
[ ] H2O Quality (Specified Below)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
		C	4 DEG C	1 L P-CUBE	[ ]	__/__/__/__
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	__/__/__/__
[ ] Coliform	303,909		4 DEG C	(1) 4 OZ	[ ]	__/__/__/__
[✓] EPH/VPH			HCl/H2SO4/4°C (VPH) (EPH)	Sterile	[✓]	__/__/__/__

Analysis	Method Number	Fraction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	4 DEG C	(2) 2OZ AG	[✓]	__/__/__/__
[✓] SVOC	LM18	SS		(1) 16 OZ AG	[✓]	__/__/__/__
[✓] Pest/PCB	LH16	SS			[✓]	__/__/__/__
	LH10				[ ]	__/__/__/__
[✓] PAL Inorganics	See Below	SS			[✓]	__/__/__/__
[ ] Explosives	LW12	SS			[ ]	__/__/__/__
[✓] TPHC	418.1	SS			[✓]	__/__/__/__
[ ] Lead Only	JD17	SS			[ ]	__/__/__/__
[✓] TOC	415.1	SS			[✓]	__/__/__/__
[ ] TCLP	1311	SS	4 DEG C	(1) 16 OZ AG	[ ]	__/__/__/__
[✓] EPH/VPH			4°C/MeOH		[✓]	

NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

*actual start time = 0935
actual end time = 1000

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens Site: AOC 57 Area 2
Project Number: 09144.08 Date: 5/21/98
Site Identification: 57W-98-03X/57D-98-03X
Time: Start: see notes End: 1930 Signature of Sampler: Nancy E. R[illegible]

SURFACE WATER INFORMATION

Field Sample No. WX570300 Water Depth 1"
Depth of Sample From Top of Water 0 (ft) Temperature 15.0 Deg. C.
Spec. Cond. 946 µMHOS/CM pH 6.01 Units
Turb. 999+ ntus
DO 0 mg/L
Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [ ] Seep
[✓] Marsh

Sample Location Sketch: [ ] Yes [✓] No see map

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

Equipment Used For Collection:
[✓] ~~None~~, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump / Si + PVC tubing/inline filter
* used for 1 L AG because too shallow
* Dug a sump (ground is saturated)

SEDIMENT INFORMATION

Field Sample No. DX570300
Depth of Sediment Sample 1-1.5 (ft)
Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id ______

SD located ~ 1 foot under dense tussock & marsh mat

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[✓] Sand (some)
[✓] Organic
[ ] Gravel
[✓] silt

Sample Observations:
[ ] Odor
[✓] Color black
[ ]

SAMPLES COLLECTED

Analysis	Method Number	Faction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	UM20	VP	HCL, 4 DEG C	(4) 40 ML	[✓]	/ / /
[✓] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[✓]	/ / /
[✓] Pest/PCB	UH02	EC	4 DEG C	(2) 1 L AG	[✓]	/ / /
	UH13					/ / /
[✓] PAL Inorganics (Specified Below)		N/NF	HNO3 TO pH<2	1 L P-CUBE	[✓]	/ / /
[ ] Lead Only	SD20	N	HNO3 TO pH<2		[ ]	/ / /
[ ] Explosives	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	/ / /
	UW32					/ / /
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	/ / /
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
[ ] Anions	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	/ / /
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[ ]	/ / /
[✓] TSS Only	160.2	C	4 DEG C	1 L P-CUBE	[✓]	/ / /
[ ] H2O Quality (Specified Below)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
		C	4 DEG C	1 L P-CUBE	[ ]	/ / /
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	/ / /
[ ] Coliform	303,909		4 DEG C	(1) 4 OZ Sterile	[ ]	/ / /
[✓] EPH/VPH			HCl/H_2SO_4/4°C (VPH) (EPH)		[✓]	/ / /

Analysis	Method Number	Fraction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	4 DEG C	(2) 2OZ AG	[✓]	/ / /
[✓] SVOC	LM18	SS		(1) 16 OZ AG	[✓]	/ / /
[✓] Pest/PCB	LH16	SS		↓	[✓]	/ / /
	LH10					/ / /
[✓] PAL Inorganics	See Below	SS			[✓]	/ / /
[ ] Explosives	LW12	SS			[ ]	/ / /
[✓] TPHC	418.1	SS			[✓]	/ / /
[ ] Lead Only	JD17	SS			[ ]	/ / /
[✓] TOC	415.1	SS			[✓]	/ / /
[ ] TCLP	1311	SS	4 DEG C	(1) 16 OZ AG	[ ]	/ / /
[✓] EPH/VPH			4°C/HCl		[✓]	

NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

actual start time = 1015
actual end time = 1045

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 3

SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57W-98-04X 57D-98-04X
Time: Start: 1200 End: 1220
Site: AOC 57 Area 3
Date: 5/21/98
Signature of Sampler: Nancy E. Rorka

SURFACE WATER INFORMATION

Field Sample No. WX570400
Water Depth <1" dug out a sump + let H2O fill sump (ground is saturated)
Depth of Sample From Top of Water 0 (ft)
Temperature 17.3 Deg. C.
Spec. Cond. 56 µMHOS/CM
pH 6.35 Units
Turb. 999+ ntus
DO 0 mg/L

Type of Surface Water: [ ] Stream [ ] Pond/Lake [ ] River [✓] Seep

Sample Location Sketch: [ ] Yes [✓] No see map

Equipment Used For Collection: [✓] ~~None~~ Grab Into Bottle [ ] Bomb Sampler [✓] Pump/ Si+PVC tubing/in-line filter [✓] SS bowl + spoon (b/c too shallow)

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record ______

SEDIMENT INFORMATION

Field Sample No. WD570400
Depth of Sediment Sample 0-1 (ft)
Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id ______

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[ ] Sand
[✓] Organic
[ ] Gravel
[✓] sandy silt - black to grey black ~2" soft org. mat over org. sandy silt.

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

SAMPLES COLLECTED

Analysis	Method Number	Faction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	UM20	VP	HCL, 4 DEG C	(4) 40 ML	[✓]	___/___/___/___
[✓] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[✓]	___/___/___/___
[✓] Pest/PCB	UH02	EC	4 DEG C	(2) 1 L AG	[✓]	___/___/___/___
	UH13					___/___/___/___
[✓] PAL Inorganics (Specified Below)		N/NF	HNO3 TO pH<2	1 L P-CUBE	[✓]	___/___/___/___
[ ] Lead Only	SD20	N	HNO3 TO pH<2		[ ]	___/___/___/___
[ ] Explosives	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	___/___/___/___
	UW32					___/___/___/___
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	___/___/___/___
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
[ ] Anions	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	___/___/___/___
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
[✓] TSS Only	160.2	C	4 DEG C	1 L P-CUBE	[✓]	___/___/___/___
[ ] H2O Quality (Specified Below)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
		C	4 DEG C	1 L P-CUBE	[ ]	___/___/___/___
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
[ ] Coliform	303,909		4 DEG C	(1) 4 OZ Sterile	[✓]	___/___/___/___
[✓] EPH/VPH			HCl/H2SO4/4°C (VPH) (EPH)			___/___/___/___

Analysis	Method Number	Fraction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	4 DEG C	(2) 2OZ AG	[✓]	___/___/___/___
[✓] SVOC	LM18	SS		(1) 16 OZ AG	[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS		↓	[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[✓] TOC	415.1	SS			[✓]	___/___/___/___
[ ] TCLP	1311	SS	4 DEG C	(1) 16 OZ AG		___/___/___/___
[✓] EPH/VPH			4°C/MeOH		[✓]	

NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57W-98-05X/ 57D-98-05X
Time: Start: 1250 End: 1300
Site: AOC 57 Area 3
Date: 5/21/98
Signature of Sampler: Nancy E. Ro[illegible]

SURFACE WATER INFORMATION

Field Sample No. WX570500 Water Depth 6" (ft)

Depth of Sample From Top of Water 0" (ft) Temperature 18.3 Deg. C.

Spec. Cond. 158 µMHOS/CM pH 6.63 Units

Turb. 999+ ntus

DO 0 mg/L

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [✓] Seep

Equipment Used For Collection:
[ ] None, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump/ Si+ PVC tubing/in-line filter

Sample Location Sketch: [ ] Yes [✓] No see map

*heavy floc

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

SEDIMENT INFORMATION

Field Sample No. DX570500

Depth of Sediment Sample 0-4" (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] Silt

Sample Observations:
[ ] Odor
[ ] Color
[✓] Fe Floc

SAMPLES COLLECTED

Analysis	Method Number	Faction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	UM20	VP	HCL, 4 DEG C	(4) 40 ML	[✓]	/ / /
[✓] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[✓]	/ / /
[✓] Pest/PCB	UH02	EC	4 DEG C	(2) 1 L AG	[✓]	/ / /
	UH13					/ / /
[✓] PAL Inorganics (Specified Below)		N/NF	HNO3 TO pH<2	1 L P-CUBE	[✓]	/ / /
[ ] Lead Only	SD20	N	HNO3 TO pH<2		[ ]	/ / /
[ ] Explosives	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	/ / /
	UW32					/ / /
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	/ / /
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
[ ] Anions	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	/ / /
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[ ]	/ / /
[✓] TSS Only	160.2	C	4 DEG C	1 L P-CUBE	[✓]	/ / /
[ ] H2O Quality (Specified Below)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
		C	4 DEG C	1 L P-CUBE	[ ]	/ / /
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	/ / /
[ ] Coliform	303,909		4 DEG C	(1) 4 OZ Sterile	[ ]	/ / /
[✓] EPH/VPH		HCl/H_2SO_4/4°C (VPH) (EPH)			[✓]	/ / /

Analysis	Method Number	Fraction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	4 DEG C	(2) 2OZ AG	[✓]	/ / /
[✓] SVOC	LM18	SS		(1) 16 OZ AG	[✓]	/ / /
[✓] Pest/PCB	LH16	SS			[✓]	/ / /
	LH10				[ ]	/ / /
[✓] PAL Inorganics	See Below	SS			[✓]	/ / /
[ ] Explosives	LW12	SS			[ ]	/ / /
[✓] TPHC	418.1	SS			[✓]	/ / /
[ ] Lead Only	JD17	SS			[ ]	/ / /
[✓] TOC	415.1	SS			[✓]	/ / /
[ ] TCLP	1311	SS	4 DEG C	(1) 16 OZ AG		/ / /
[✓] EPH/VPH			4°C/MeOH		[✓]	/ / /

NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/S04 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

- Frog observed jumping into H_2O
- Heavy floc in H_2O

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 3

SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57W-98-06X/ 57D-98-06X
Time: Start: 1345 End: 1400
Site: AOC 57 Area 3
Date: 5/21/98
Signature of Sampler: Nancy E. Rota

SURFACE WATER INFORMATION

Field Sample No. WX570600 Water Depth 4" ~~(ft)~~

Depth of Sample From Top of Water 0 (ft) Temperature 17.7 Deg. C.

Spec. Cond. 51 µMHOS/CM pH 6.00 Units

Turb. 999+ ntus
DO 0.36 mg/L

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [✓] Seep

Sample Location Sketch: [ ] Yes [✓] No see map

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

dug a sump (ground is saturated)

Equipment Used For Collection:
[✓] ~~None~~, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump/ Si+ PVC tubing/in-line filter
[✓] SS bowl (shallow)

SEDIMENT INFORMATION

Field Sample No. DX570600

Depth of Sediment Sample 0-1 (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id ______

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] Silt

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

SAMPLES COLLECTED

Analysis	Method Number	Faction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	UM20	VP	HCL, 4 DEG C	(4) 40 ML	[✓]	___/___/___/___
[✓] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[✓]	___/___/___/___
[✓] Pest/PCB	UH02	EC.	4 DEG C	(2) 1 L AG	[✓]	___/___/___/___
	UH13					___/___/___/___
[✓] PAL Inorganics (Specified Below)		N/NF	HNO3 TO pH<2	1 L P-CUBE	[✓]	___/___/___/___
[ ] Lead Only	SD20	N	HNO3 TO pH<2		[ ]	___/___/___/___
[ ] Explosives	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	___/___/___/___
	UW32					___/___/___/___
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	___/___/___/___
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
[ ] Anions	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	___/___/___/___
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
[✓] TSS Only	160.2	C	4 DEG C	1 L P-CUBE	[✓]	___/___/___/___
[ ] H2O Quality (Specified Below)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
		C	4 DEG C	1 L P-CUBE	[ ]	___/___/___/___
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
[ ] Coliform	303,909		4 DEG C	(1) 4 OZ Sterile	[✓]	___/___/___/___
[✓] EPH/VPH			HCl/H_2SO_4/4°C (VPH) (EPH)			___/___/___/___

Analysis	Method Number	Fraction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	4 DEG C	(2) 2OZ AG	[✓]	___/___/___/___
[✓] SVOC	LM18	SS		(1) 16 OZ AG	[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS			[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[✓] TOC	415.1	SS		↓	[✓]	___/___/___/___
[ ] TCLP	1311	SS	4 DEG C	(1) 16 OZ AG	[✓]	___/___/___/___
[✓] EPH/VPH			4°C/MeOH			

NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 3

SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57D-98-07X / 57W-98-07X
Time: Start: 1430 End: 1445
Signature of Sampler: Nancy E. Rofka

SURFACE WATER INFORMATION

Field Sample No. WX570700 Water Depth 6" ~~(ft)~~

Depth of Sample From Top of Water 0 (ft) Temperature 20.2 Deg. C.

Spec. Cond. 50 µMHOS/CM pH 6.14 Units

Turb. 999+ ntus

DO 0 mg/L

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [✓] Seep

Sample Location Sketch: [ ] Yes [✓] No see map

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

Equipment Used For Collection:
[✓] ~~None~~, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump / Si+ PVC tubing/in-line filter

& dug a sump (ground is saturated)

SEDIMENT INFORMATION

Field Sample No. DX570700

Depth of Sediment Sample 0-6" ~~(ft)~~

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id ______

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] Silt

Sample Observations:
[✓] Odor H_2S
[ ] Color
[ ]

SAMPLES COLLECTED

Analysis	Method Number	Faction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	UM20	VP	HCL, 4 DEG C	(4) 40 ML	[✓]	/ / /
[✓] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[✓]	/ / /
[✓] Pest/PCB	UH02	EC	4 DEG C	(2) 1 L AG	[✓]	/ / /
	UH13					/ / /
[✓] PAL Inorganics (Specified Below)		N/NF	HNO3 TO pH<2	1 L P-CUBE	[✓]	/ / /
[ ] Lead Only	SD20	N	HNO3 TO pH<2		[ ]	/ / /
[ ] Explosives	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	/ / /
	UW32					/ / /
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	/ / /
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
[ ] Anions	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	/ / /
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[ ]	/ / /
[✓] TSS Only	160.2	C	4 DEG C	1 L P-CUBE	[✓]	/ / /
[ ] H2O Quality (Specified Below)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	/ / /
		C	4 DEG C	1 L P-CUBE	[ ]	/ / /
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	/ / /
[ ] Coliform	303,909		4 DEG C	(1) 4 OZ Sterile	[✓]	/ / /
[✓] EPH/VPH			HCl/H_2SO_4/4°C (VPH) (EPH)			/ / /

Analysis	Method Number	Fraction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	4 DEG C	(2) 2OZ AG	[✓]	/ / /
[✓] SVOC	LM18	SS		(1) 16 OZ AG	[✓]	/ / /
[✓] Pest/PCB	LH16	SS			[✓]	/ / /
	LH10				[ ]	/ / /
[✓] PAL Inorganics	See Below	SS			[✓]	/ / /
[ ] Explosives	LW12	SS			[ ]	/ / /
[✓] TPHC	418.1	SS			[✓]	/ / /
[ ] Lead Only	JD17	SS			[ ]	/ / /
[✓] TOC	415.1	SS			[✓]	/ / /
[ ] TCLP	1311	SS	4 DEG C	(1) 16 OZ AG	[ ]	/ / /
[✓] EPH/VPH			4°C/MeOH		[✓]	

NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 3

SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57W-98-08X / 57D-98-08X
Time: Start: 1310 End: 1330
Signature of Sampler: Nancy E. Roka

SURFACE WATER INFORMATION

Field Sample No. WX570800 Water Depth 6" ~~(ft)~~

Depth of Sample From Top of Water 0 (ft) Temperature 20.6 Deg. C.

Spec. Cond. 103 µMHOS/CM pH 6.63 Units

Turb. 999+ ntus

DO 0 mg/L

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID ______

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [✓] Seep

Equipment Used For Collection:
[ ] None, Grab into Bottle
[ ] Bomb Sampler
[✓] Pump / Si + PVC tubing / in-line filter

Sample Location Sketch: [ ] Yes [✓] No see map

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record ______

SEDIMENT INFORMATION

Field Sample No. DX570800

Depth of Sediment Sample 0-6" ~~(ft)~~

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id ______

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] silt

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor ______
[ ] Color ______
[ ] ______

SAMPLES COLLECTED

Analysis	Method Number	Faction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	UM20	VP	HCL, 4 DEG C	(4) 40 ML	[✓]	___/___/___/___
[✓] SVOC	UM18	MS	4 DEG C	(2) 1 L AG	[✓]	___/___/___/___
[✓] Pest/PCB	UH02	EC	4 DEG C	(2) 1 L AG	[✓]	___/___/___/___
	UH13					___/___/___/___
[✓] PAL Inorganics (Specified Below)		N/NF	HNO3 TO pH<2	1 L P-CUBE	[✓]	___/___/___/___
[ ] Lead Only	SD20	N	HNO3 TO pH<2		[ ]	___/___/___/___
[ ] Explosives	UW19	LC	4 DEG C	(3) 1 L AG	[ ]	___/___/___/___
	UW32					___/___/___/___
[ ] TPHC	418.1	O	H2SO4 TO pH<2	1 L AG	[ ]	___/___/___/___
[ ] TOC	415.1	O	H2SO4 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
[ ] Anions	TF22	S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
	TT10	C	4 DEG C	1 L P-CUBE	[ ]	___/___/___/___
	310.1	N	HNO3 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
[✓] TSS Only	160.2	C	4 DEG C	1 L P-CUBE	[✓]	___/___/___/___
[ ] H2O Quality (Specified Below)		S	H2SO4 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
		C	4 DEG C	1 L P-CUBE	[ ]	___/___/___/___
		N	HNO3 TO pH<2	1 L P-CUBE	[ ]	___/___/___/___
[ ] Coliform	303,909		4 DEG C	(1) 4 OZ	[ ]	___/___/___/___
[✓] EPH/VPH			HCl/H2SO4/4°C (VPH) (EPH)	Sterile	[✓]	___/___/___/___

Analysis	Method Number	Fraction Code	Preservation Method	Volume Required	Sample Collected	Sample Bottle ID Numbers
[✓] VOC	LM19	SV	4 DEG C	(2) 2OZ AG	[✓]	___/___/___/___
[✓] SVOC	LM18	SS		(1) 16 OZ AG	[✓]	___/___/___/___
[✓] Pest/PCB	LH16	SS		↓	[✓]	___/___/___/___
	LH10				[ ]	___/___/___/___
[✓] PAL Inorganics	See Below	SS			[✓]	___/___/___/___
[ ] Explosives	LW12	SS			[ ]	___/___/___/___
[✓] TPHC	418.1	SS			[✓]	___/___/___/___
[ ] Lead Only	JD17	SS			[ ]	___/___/___/___
[✓] TOC	415.1	SS			[✓]	___/___/___/___
[ ] TCLP / [✓] EPH/VPH	1311	SS	4 DEG C / 4°C/MeOH	(1) 16 OZ AG	[✓]	___/___/___/___

NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered
PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

SURVEY DATA

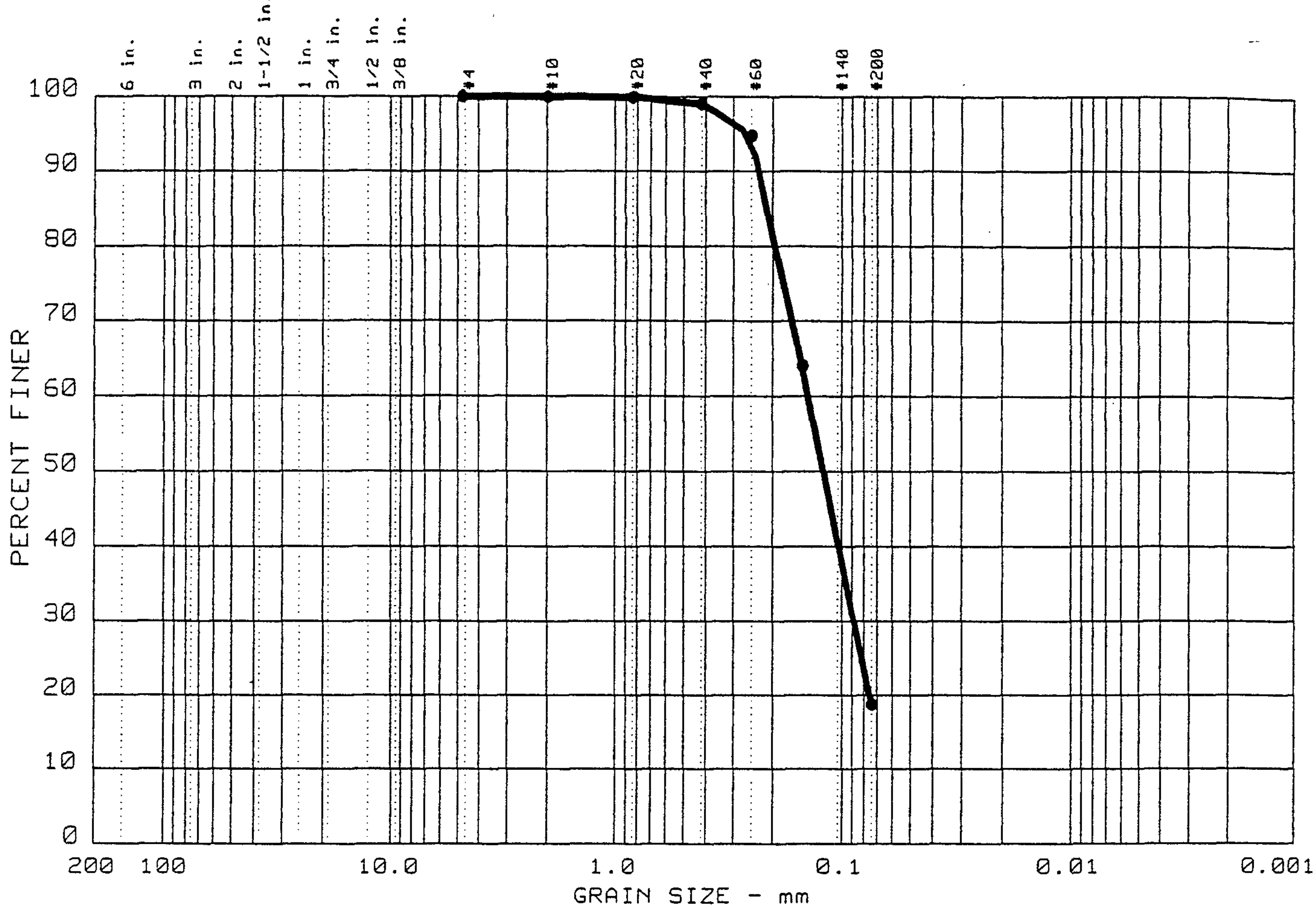
Table I-1
MONITORING WELL AND PIEZOMETER DATA
AOC 57

REMEDIAL INVESTIGATION REPORT
FORT DEVENS, MA

WELL	NORTH	EAST	TOP OF PVC	GROUND ELEVATION
G3M-92-02X	562277	575908	251	249.11
G3M-92-07X	562586	576145	251.88	249.97
57M-95-01X	562062.51	576806.44	248.19	245.70
57M-95-02X	561853.36	575850.79	242.16	239.97
57M-95-03X	562331.40	576954.31	234.97	232.48
57M-95-04A	561870.62	576382.18	223.83	222.68
57M-95-04B	561863.18	576381.34	224.67	222.38
57M-95-05X	561952.54	576228.93	237.31	234.87
57M-95-06X	562051.57	576463.95	236.56	234.42
57M-95-07X	561825.75	576248.67	224.57	223.36
57M-95-08A	561934.81	576468.16	224.11	222.67
57M-95-08B	561932.96	576475.11	224.70	222.24
57M-96-09X	562419.79	576853.00	242.62	240.24
57M-96-10X	562293.21	577012.99	229.55	227.09
57M-96-11X	562225.94	576968.72	224.38	222.18
57M-96-12X	562240.19	576870.69	227.87	224.82
57M-96-13X	562193.54	576811.74	227.73	225.06
57P-95-01A	561695.11	576211.02	223.29	222.00
57P-95-01B	561695.11	576211.02	223.10	222.00

GEOTECHNICAL DATA (GRAIN SIZE)

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	81.2	18.8		SP-SM		

SIEVE inches size	PERCENT FINER ●		

	GRAIN SIZE		
D_{60}	0.14		
D_{30}	0.09		
D_{10}			

	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
4	100.0		
10	100.0		
20	99.9		
40	99.0		
60	94.8		
100	64.1		
200	18.8		

Sample information:
● BX570805
F SAND; Lttl Si;
Tr M and C Sa.

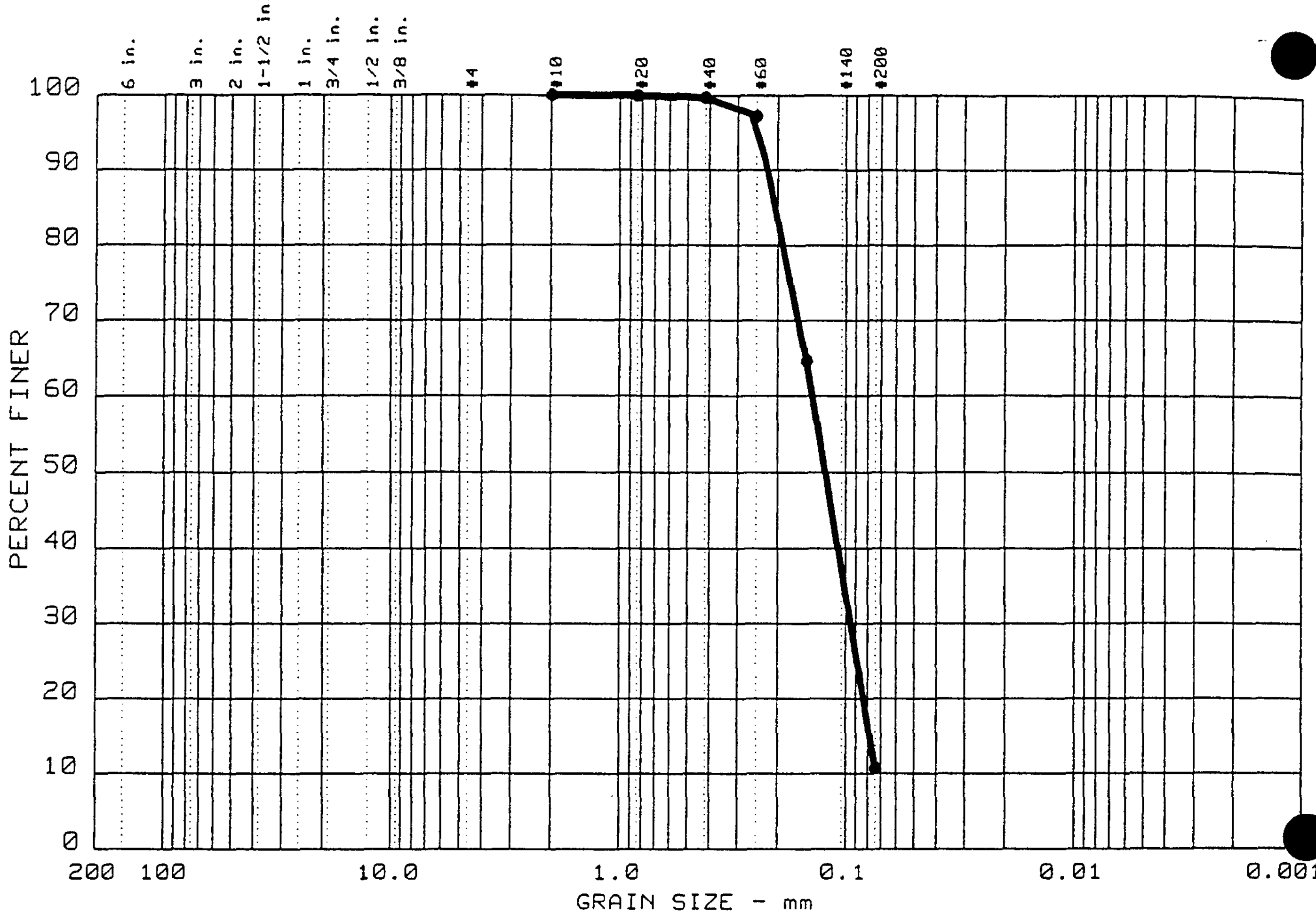
Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	89.3	10.7		SP		

SIEVE inches size	PERCENT FINER ●		
	GRAIN SIZE		
D_{60}	0.14		
D_{30}	0.10		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
10	100.0		
20	99.9		
40	99.7		
60	97.2		
100	64.7		
200	10.7		

Sample information:
● BX570905
F SAND; Lttl Si; Tr M Sa.

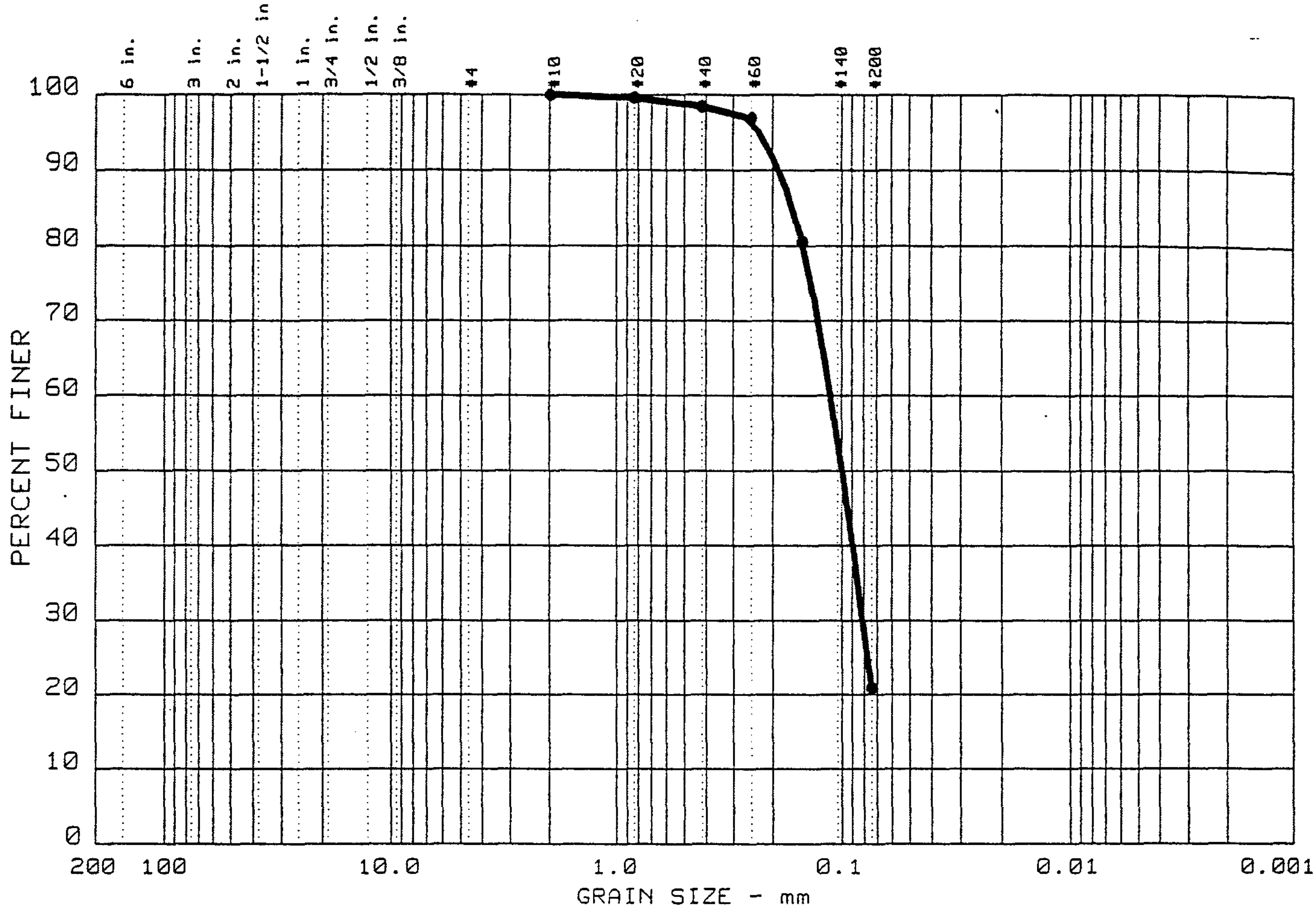
Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	79.1	20.9		SM		

SIEVE inches size	PERCENT FINER ●		

	GRAIN SIZE		
D_{60}	0.11		
D_{30}	0.08		
D_{10}			

	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
10	100.0		
20	99.6		
40	98.4		
60	96.8		
100	80.5		
200	20.9		

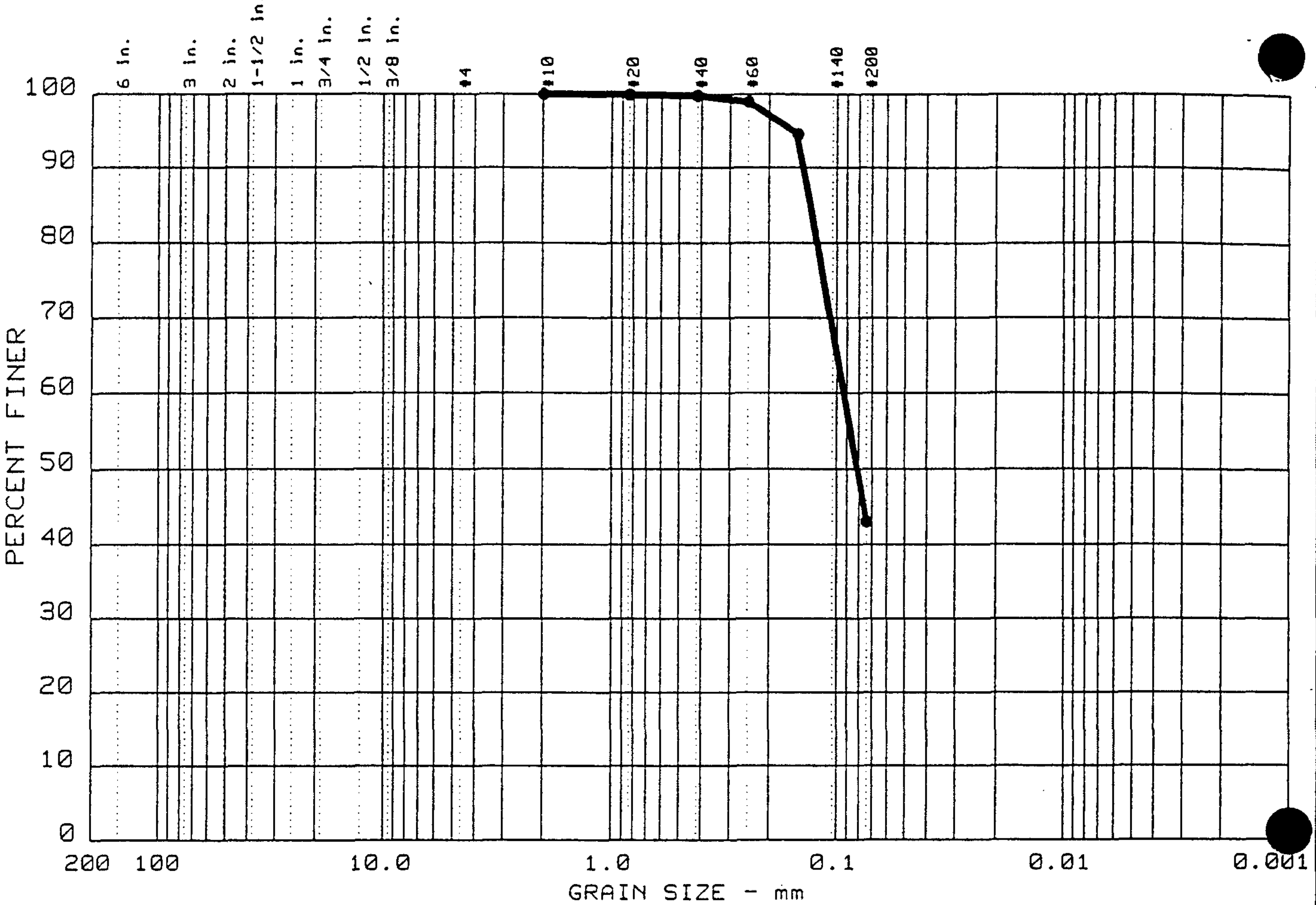
Sample information:
● BX571005
F SAND; Sm Si; Tr M Sa.

Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS
Date: 10/10/96 Data Sheet No. 21

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	57.0	43.0		SM		

SIEVE inches size	PERCENT FINER ●		
	GRAIN SIZE		
D_{60}	0.09		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
10	100.0		
20	99.9		
40	99.8		
60	98.9		
100	94.5		
200	43.0		

Sample information:
● BX571105
Silty F SAND; Tr M Sa.

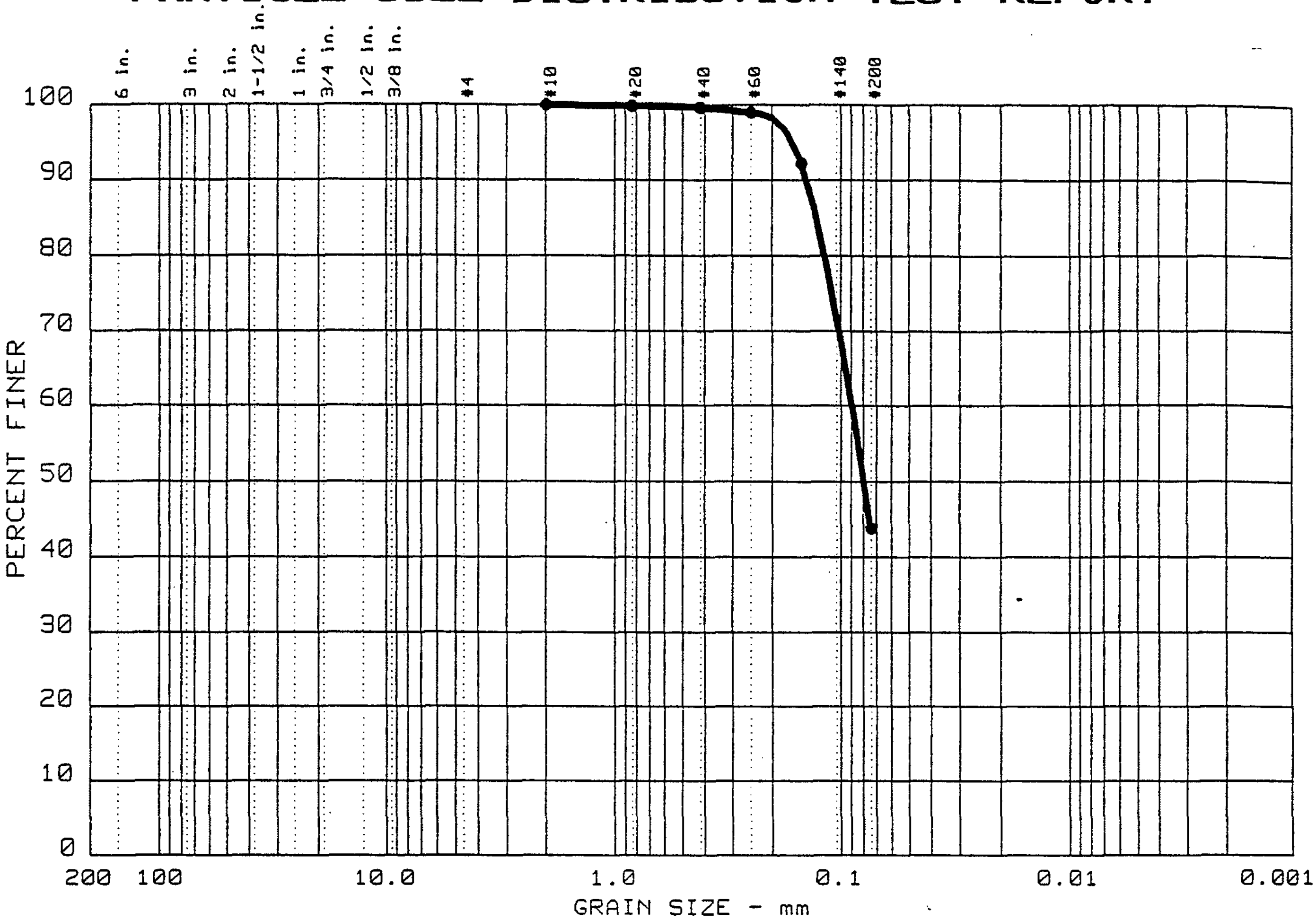
Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	56.2	43.8		SM		

SIEVE inches size	PERCENT FINER ●		
	GRAIN SIZE		
D_{60}	0.09		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
10	100.0		
20	99.8		
40	99.6		
60	99.0		
100	92.2		
200	43.8		

Sample information:
● BX571204
Silty F SAND; Tr M Sa.

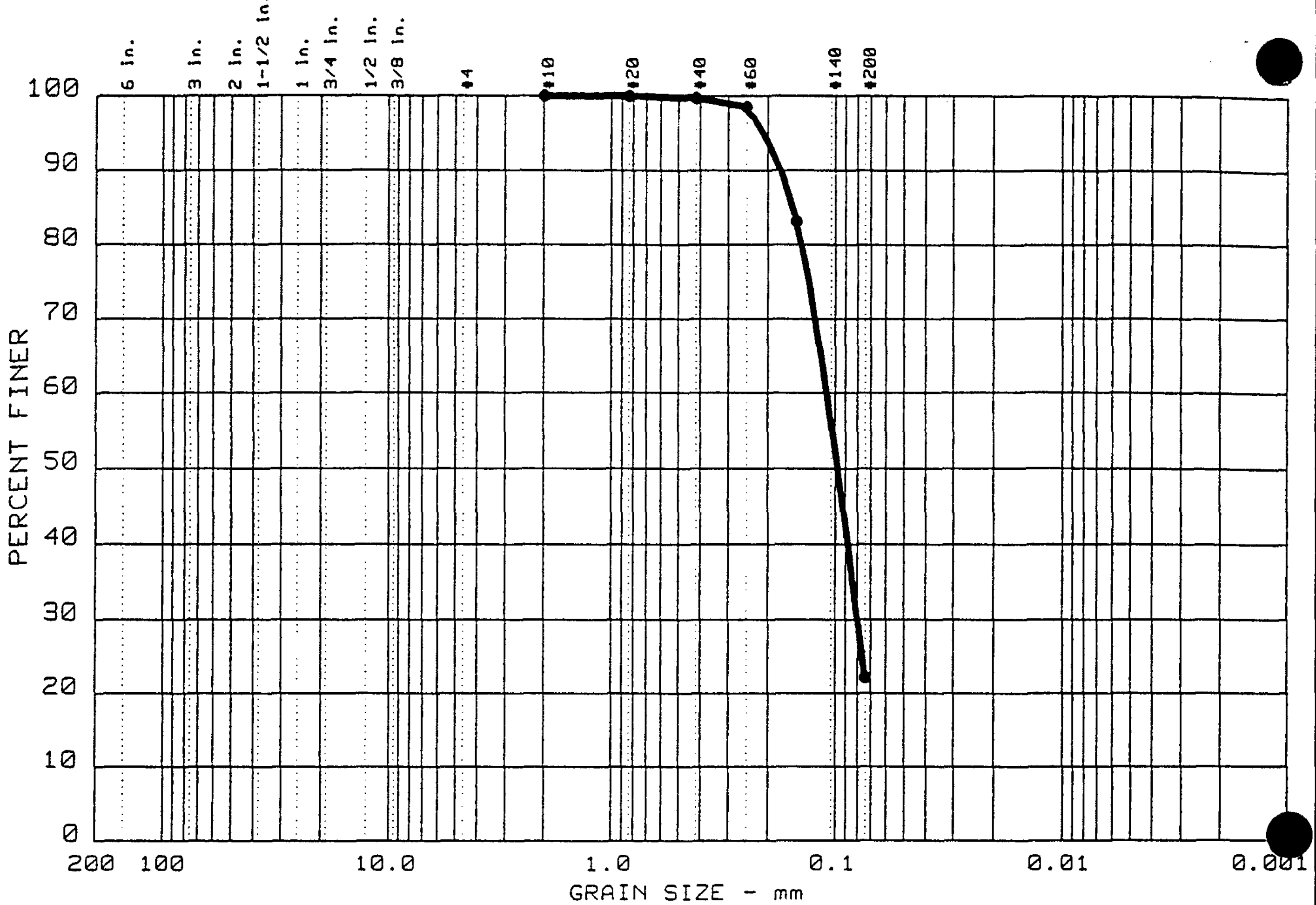
Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	77.8	22.2		SM		

SIEVE inches size	PERCENT FINER ●		
	GRAIN SIZE		
D_{60}	0.11		
D_{30}	0.08		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ●		
10	100.0		
20	100.0		
40	99.7		
60	98.4		
100	83.1		
200	22.2		

Sample information:
● BX571305
F SAND; Sm Si; Tr M Sa.

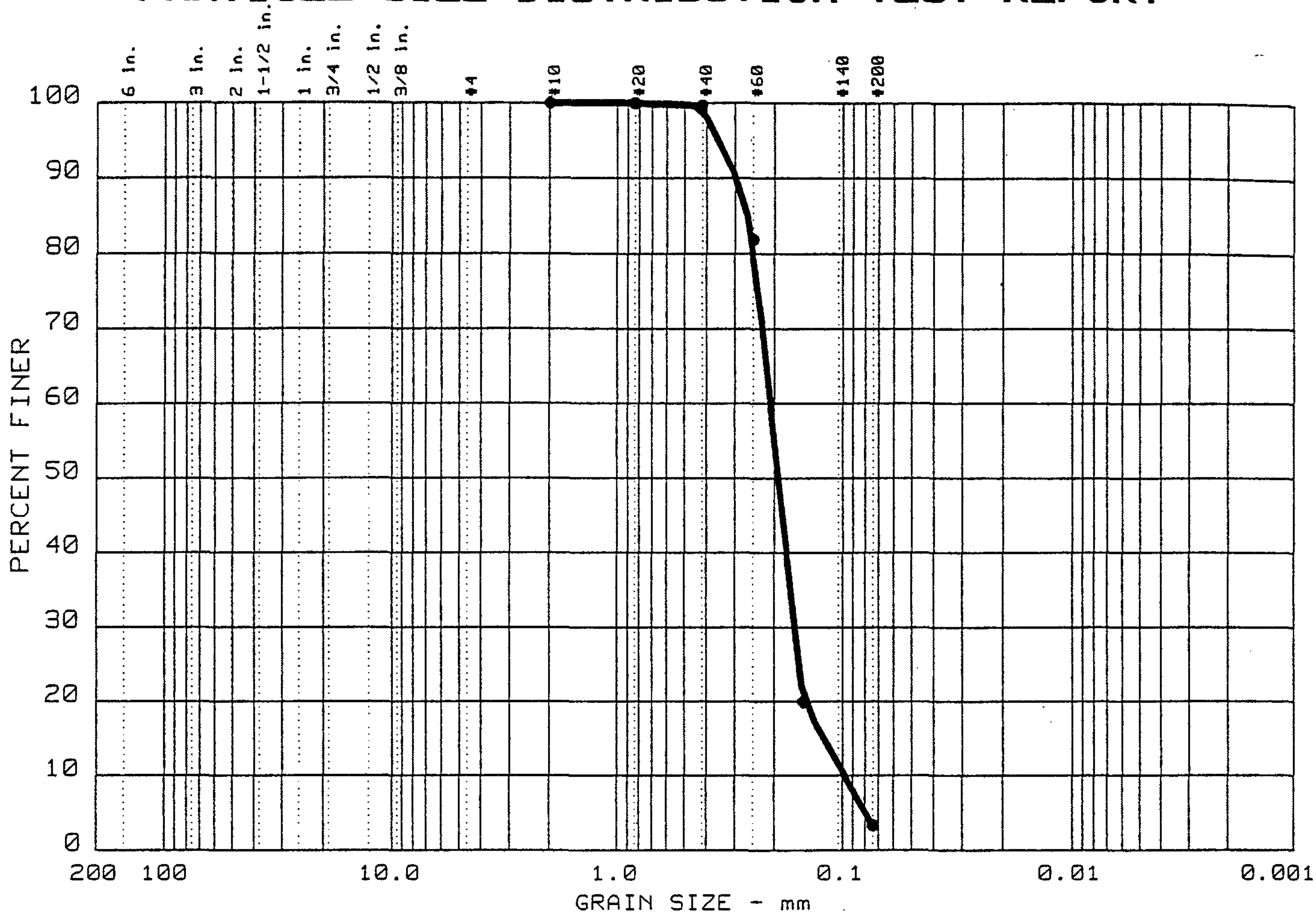
Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	96.7	3.3		SP		

SIEVE inches size	PERCENT FINER ●		
	GRAIN SIZE		
D_{60}	0.21		
D_{30}	0.16		
D_{10}	0.09		
	COEFFICIENTS		
C_c	1.29		
C_u	2.1		

SIEVE number size	PERCENT FINER ●		
10	100.0		
20	99.9		
40	99.6		
60	81.9		
100	20.0		
200	3.3		

Sample information:
● EF572810
F SAND; Tr Si and M Sa.

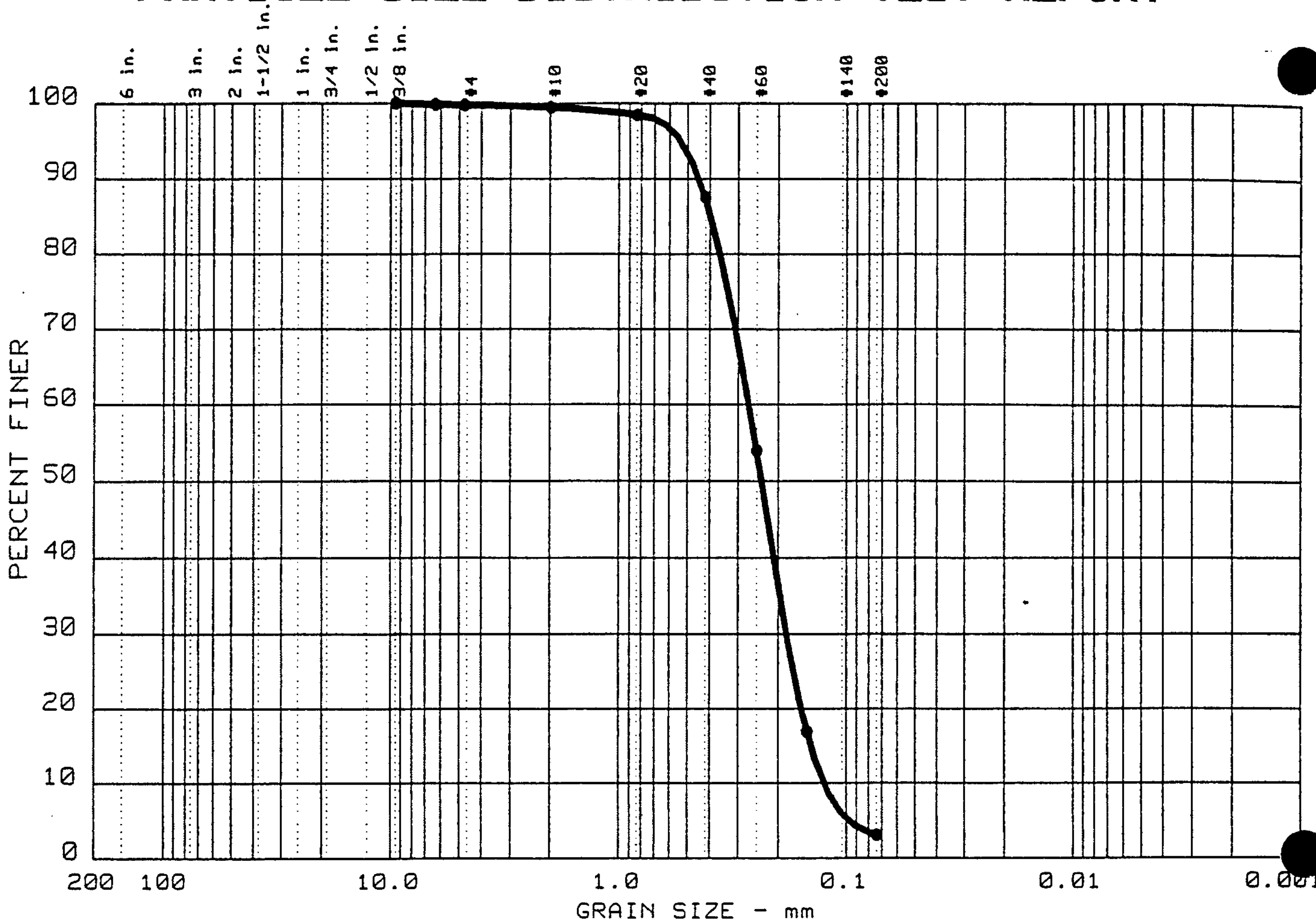
Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.3	96.7	3.0		SP		

SIEVE inches size	PERCENT FINER ●		
0.375	100.0		
0.25	99.8		
	GRAIN SIZE		
D_{60}	0.27		
D_{30}	0.18		
D_{10}	0.12		
	COEFFICIENTS		
C_c	1.00		
C_u	2.2		

SIEVE number size	PERCENT FINER ●		
4	99.7		
10	99.4		
20	98.4		
40	87.5		
60	54.0		
100	16.9		
200	3.1		

Sample information:
● EX572911
F SAND; Tr M Sa and Si.

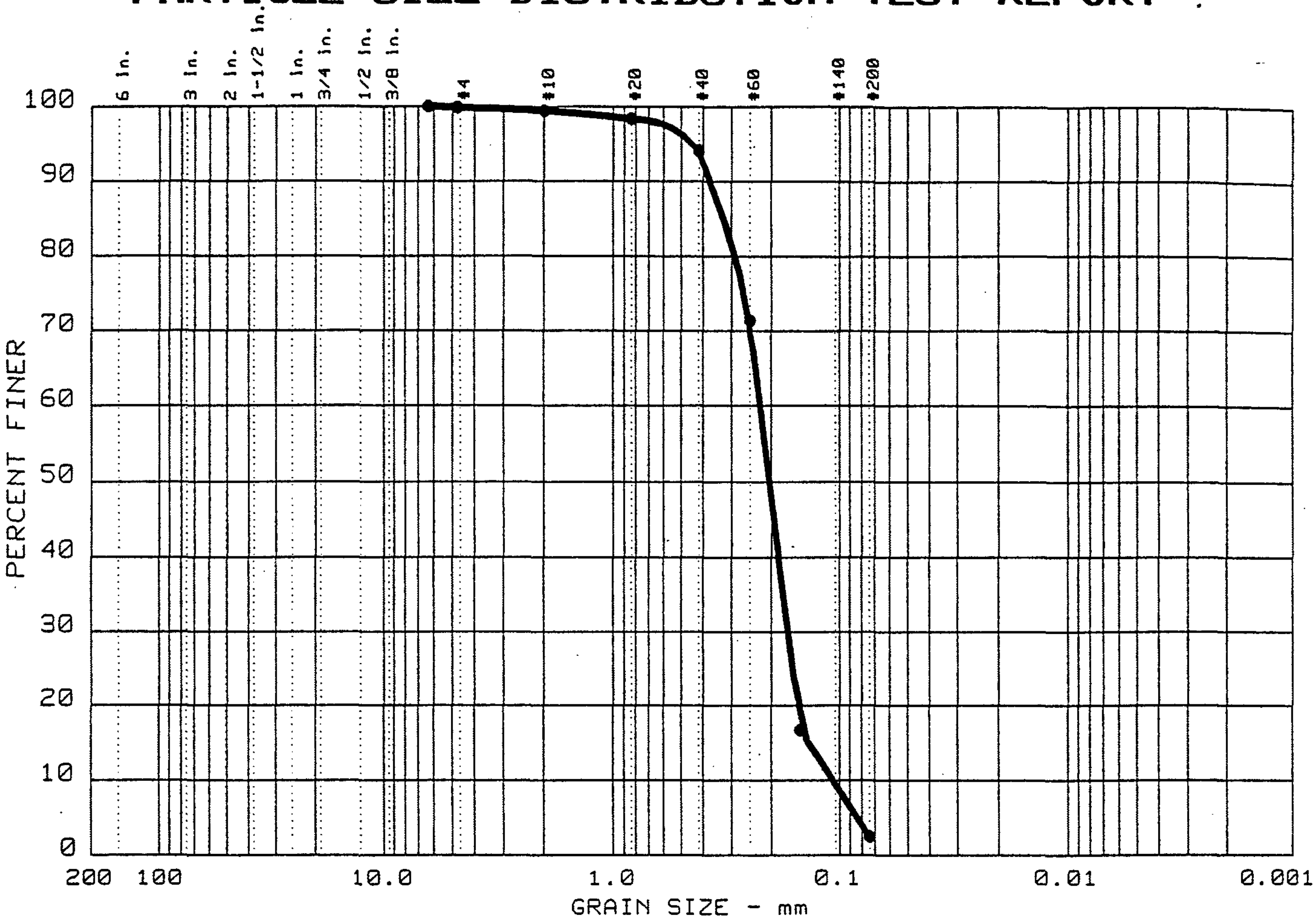
Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.2	97.4	2.4		SP		

SIEVE inches size	PERCENT FINER ●		
0.25	100.0		
	GRAIN SIZE		
D_{60}	0.22		
D_{30}	0.17		
D_{10}	0.10		
	COEFFICIENTS		
C_c	1.19		
C_u	2.1		

SIEVE number size	PERCENT FINER ●		
4	99.8		
10	99.4		
20	98.4		
40	94.1		
60	71.4		
100	16.8		
200	2.5		

Sample information:
● EX573106
F SAND; Tr M and C Sa and Si.

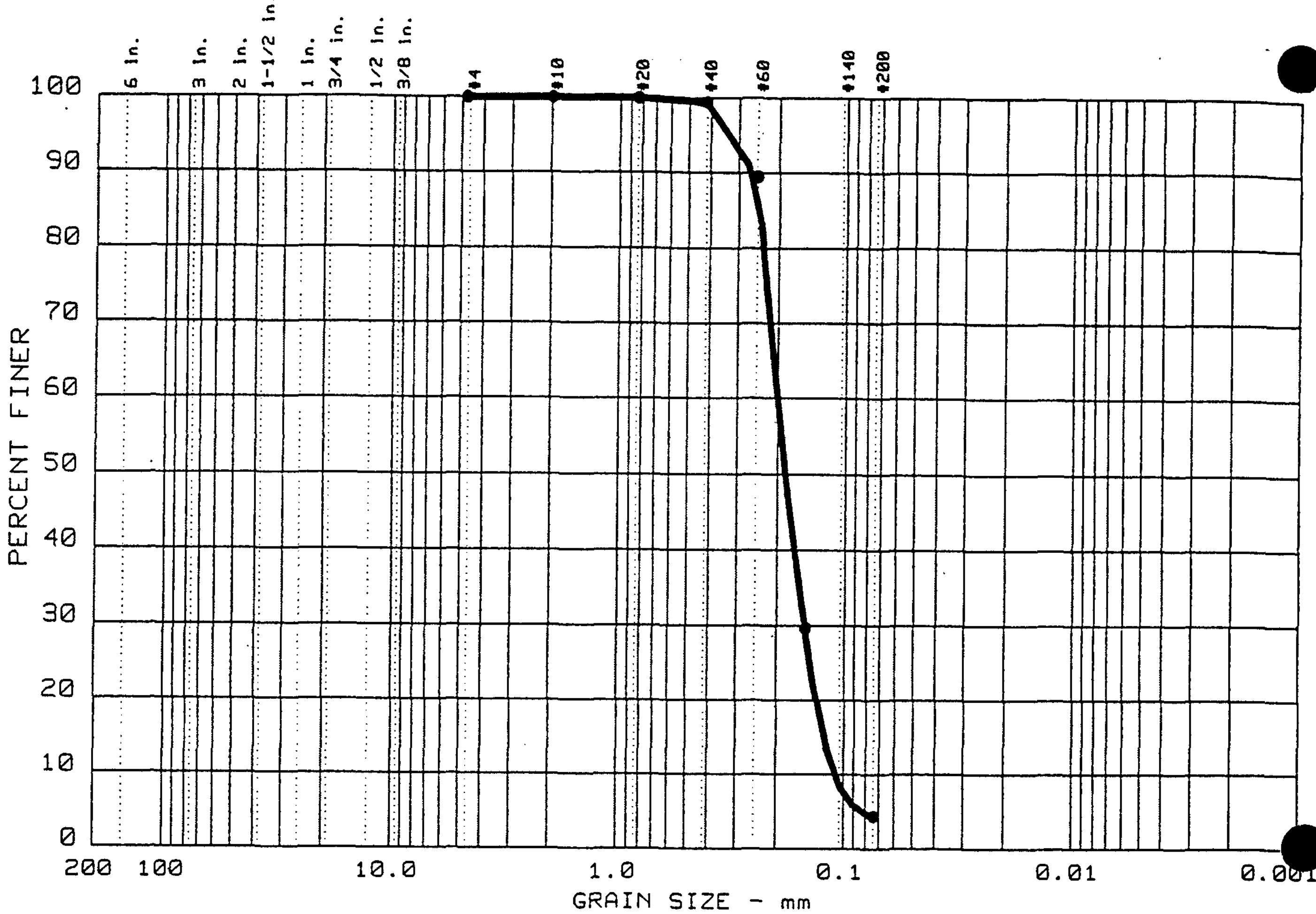
Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	0.0	95.6	4.4		SP		

SIEVE inches size	PERCENT FINER ●		
	GRAIN SIZE		
D_{60}	0.20		
D_{30}	0.15		
D_{10}	0.10		
	COEFFICIENTS		
C_c	1.01		
C_u	1.8		

SIEVE number size	PERCENT FINER ●		
4	100.0		
10	100.0		
20	100.0		
40	99.4		
60	89.4		
100	29.6		
200	4.4		

Sample information:
● 57M-96-09X
F SAND; Tr M and C Sa and Si.

Remarks:
SIEVE ANALYSIS

ABB Environmental Services, Inc.

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

PROJECT ANALYTE LIST

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
PAL INORGANICS					
AL	ALUMINUM	2.35	ug/g	141	ug/l
SB	ANTIMONY	0.109	ug/g	3.03	ug/l
AS	ARSENIC	0.25	ug/g	2.54	ug/l
BA	BARIUM	5.18	ug/g	5	ug/l
BE	BERYLLIUM	0.5	ug/g	5	ug/l
CD	CADMIUM	0.7	ug/g	4.01	ug/l
CA	CALCIUM	100	ug/g	500	ug/l
CR	CHROMIUM	4.05	ug/g	6.02	ug/l
CO	COBALT	1.42	ug/g	25	ug/l
CU	COPPER	0.965	ug/g	8.09	ug/l
FE	IRON	3.68	ug/g	38.8	ug/l
PB	LEAD	0.177	ug/g	1.26	ug/l
MG	MAGNESIUM	100	ug/g	500	ug/l
MN	MANGANESE	2.05	ug/g	2.75	ug/l
HG	MERCURY	0.05	ug/g	0.243	ug/l
NI	NICKEL	1.71	ug/g	34.3	ug/l
K	POTASSIUM	100	ug/g	375	ug/l
SE	SELENIUM	0.25	ug/g	3.02	ug/l

continued

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
AG	SILVER	0.589	ug/g	4.6	ug/l
NA	SODIUM	100	ug/g	500	ug/l
TL	THALLIUM	0.319	ug/g	6.99	ug/l
V	VANADIUM	3.39	ug/g	11	ug/l
ZN	ZINC	8.03	ug/g	21	ug/l
PAL EXPLOSIVES					
135TNB	1,3,5-TRINITROBENZENE	0.488	ug/g	0.449	ug/l
13DNB	1,3-DINITROBENZENE	0.496	ug/g	0.611	ug/l
246TNT	2,4,6-TRINITROTOLUENE	0.456	ug/g	0.635	ug/l
24DNT	2,4-DINITROTOLUENE	0.424	ug/g	0.0637	ug/l
26DNT	2,6-DINITROTOLUENE	0.524	ug/g	0.0738	ug/l
HMX	CYCLOTETRAMETHYLENETETRANITRAMINE	0.666	ug/g	1.21	ug/l
NB	NITROBENZENE	2.41	ug/g	0.645	ug/l
RDX	CYCLONITE	0.587	ug/g	1.17	ug/l
TETRYL	NITRAMINE	0.731	ug/g	1.56	ug/l
NG	NITROGLYCERINE	4	ug/g	10	ug/l
PETN	PENTAERYTHRITOL TETRANITRATE	4	ug/g	20	ug/l

continued

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
PAL ANIONS/CATIONS					
HCO3	BICARBONATE	NA		NA	ug/l
CL	CHLORIDE	NA		2,120	ug/l
SO4	SULFATE	NA		10,000	ug/l
NO3	NITRATE	NA		10	ug/l
CA	CALCIUM	NA		500	ug/l
K	POTASSIUM	NA		375	ug/l
MG	MAGNESIUM	NA		500	ug/l
PAL WATER QUALITY PARAMETERS					
CL	CHLORIDES	NA		2,120	ug/l
N2KJEL	TOTAL NITROGEN	NA		183	ug/l
NIT	NO3-N	NA		10	ug/l
SO4	SULFATES	NA		10,000	ug/l
TPO4	TOTAL PHOSPHORUS	NA		13.3	ug/l
--	HARDNESS	NA		NA	ug/l
ALK	ALKALINITY	NA		NA	ug/l
TSS	TOTAL SUSPENDED SOLIDS	NA		NA	ug/l
DO	DISSOLVED OXYGEN	NA		NA	ug/l

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
PAL ORGANICS VOLATILE COMPOUNDS					
111TCE	1,1,1-TRICHLOROETHANE	0.0044	ug/g	0.5	ug/l
112TCE	1,1,2-TRICHLOROETHANE	0.0054	ug/g	1.2	ug/l
11DCE	1,1-DICHLOROETHYLENE/ 1,1-DICHLOROETHENE	0.0039	ug/g	0.5	ug/l
11DCLE	1,1-DICHLOROETHANE	0.0023	ug/g	0.68	ug/l
12DCE	1,2-DICHLOROETHYLENES, TOTAL (CIS AND TRANS ISOMERS)	0.003	ug/g	0.5	ug/l
12DCLE	1,2-DICHLOROETHANE	0.0017	ug/g	0.5	ug/l
12DCLP	1,2-DICHLOROPROPANE	0.0029	ug/g	0.5	ug/l
ACET	ACETONE	0.017	ug/g	13	ug/l
BRDCLM	BROMODICHLOROMETHANE	0.0029	ug/g	0.59	ug/l
C2H3CL	CHLOROETHENE/VINYL CHLORIDE	0.0062	ug/g	2.6	ug/l
C2H5CL	CHLOROETHANE	0.012	ug/g	1.9	ug/l
C6H6	BENZENE	0.0015	ug/g	0.5	ug/l
CCL4	CARBON TETRACHLORIDE	0.007	ug/g	0.5	ug/l
CH2CL2	METHYLENE CHLORIDE	0.012	ug/g	2.3	ug/l
CH3BR	BROMOMETHANE	0.0057	ug/g	5.8	ug/l
CH3CL	CHLOROMETHANE	0.0088	ug/g	3.2	ug/l

continued

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
CHBR3	BROMOFORM	0.0069	ug/g	2.6	ug/l
C13DCP	CIS-1,3-DICHLOROPROPYLENE C+S-1,3-DICHLOROPROPENE	0.0032	ug/g	0.58	ug/l
CHCL3	CHLOROFORM	0.00087	ug/g	0.5	ug/l
CL2CH2	DICHLOROMETHANE	12	ug/g	2.3	ug/l
CLC6H5	CHLOROBENZENE	0.00086	ug/g	0.5	ug/l
CS2	CARBON DISULFIDE	0.0044	ug/g	0.5	ug/l
DBRCLM	DIBROMOCHLOROMETHANE	0.0031	ug/g	0.67	ug/l
ETC6H5	ETHYLBENZENE	0.0017	ug/g	0.5	ug/l
MEC6H5	TOLUENE	0.00078	ug/g	0.5	ug/l
MEK	METHYLETHYL KETONE/2-BUTANONE	0.07	ug/g	6.4	ug/l
MIBK	METHYLISOBUTYL KETONE	0.027	ug/g	3	ug/l
MNBK	METHYL-N-BUTYL KETONE/2-HEXANONE	0.032	ug/g	3.6	ug/l
STYR	STYRENE	0.0026	ug/g	0.5	ug/l
T13DCP	TRANS-1,3-DICHLOROPROPENE	0.0028	ug/g	0.7	ug/l
TCLEA	1,1,2,2-TETRACHLOROETHANE	0.0024	ug/g	0.51	ug/l
TCLEE	TETRACHLOROETHYLENE/ TETRACHLOROETHENE	0.00081	ug/g	1.6	ug/l

continued

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
TRCLE	TRICHLOROTHYLENE/TRICHLOROETHENE	0.0028	ug/g	0.5	ug/l
TXYLEN	XYLENES, TOTAL COMBINED	1.5	ug/g	0.84	ug/l
PAL ORGANICS SEMIVOLATILE COMPOUNDS					
124TCB	1,2,4-TRICHLOROBENZENE	0.04	ug/g	1.8	ug/l
12DCLB	1,2-DICHLOROBENEZENE	0.11	ug/g	1.7	ug/l
13DCLB	1,3-DICHLOROBENZENE	0.13	ug/g	1.7	ug/l
14DCLB	1,4-DICHLOROBENZENE	0.098	ug/g	1.7	ug/l
245TCP	2,4,5-TRICHLOROPHENOL	0.1	ug/g	5.2	ug/l
246TCP	2,4,6-TRICHLOROPHENOL	0.17	ug/g	13	ug/l
24DCLP	2,4-DICHLOROPHENOL	0.18	ug/g	2.9	ug/l
24DMPN	2,4-DIMETHYLPHENOL	0.69	ug/g	5.8	ug/l
24DNP	2,4-DINITROPHENOL	1.2	ug/g	21	ug/l
24DNT	2,4-DINITROTOLUENE	0.14	ug/g	4.5	ug/l
26DNT	2,6-DINITROTOLUENE	0.085	ug/g	0.79	ug/l
2CLP	2-CHLOROPHENOL	0.06	ug/g	0.99	ug/l
2CNAP	2-CHLORONAPHTHALENE	0.036	ug/g	0.5	ug/l
2MNAP	2-METHYLNAPHTHALENE	0.049	ug/g	1.7	ug/l
2MP	2-METHYLPHENOL/2-CRESOL	0.029	ug/g	3.9	ug/l

continued

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
2NANIL	2-NITROANILINE	0.062	ug/g	4.3	ug/l
2NP	2-NITROPHENOL	0.14	ug/g	3.7	ug/l
33DCBD	3,3'-DICHLOROBENZIDINE	6.3	ug/g	12	ug/l
3NANIL	3-NITROANILINE	0.45	ug/g	4.9	ug/l
46DN2C	4,6-DINITRO-2-CRESOL/ METHYL-4,6-DINITROPHENOL	0.55	ug/g	17	ug/l
4BRPPE	4-BROMOPHENYLPHENYL ETHER	0.033	ug/g	4.2	ug/l
4CANIL	4-CHLOROANILINE	0.81	ug/g	7.3	ug/l
4CL3C	4-CHLORO-3-CRESOL/ 3-METHYL-4-CHLOROPHENOL	0.095	ug/g	4	ug/l
4CLPPE	4-CHLOROPHENYLPHENYL ETHER	0.033	ug/g	5.1	ug/l
4MP	4-METHYLPHENOL/4-CRESOL	0.24	ug/g	0.52	ug/l
4NANIL	4-NITROANILINE	0.41	ug/g	5.2	ug/l
4NP	4-NITROPHENOL	1.4	ug/g	12	ug/l
ANAPNE	ACENAPHTHENE	0.036	ug/g	1.7	ug/l
ANAPYL	ACENAPHTHYLENE	0.033	ug/g	0.5	ug/l
ANTRC	ANTHRACENE	0.033	ug/g	0.5	ug/l
B2CEXM	BIS (2-CHLOROETHOXY) METHANE	0.059	ug/g	1.5	ug/l
B2CIPE	BIS (2-CHLOROISOPROPYL) ETHER	0.2	ug/g	5.3	ug/l

continued

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
B2CLEE	BIS (2-CHLOROETHYL) ETHER/ 2,2-OXYBIS(1-CHLOROPROPANE)	0.033	ug/g	1.9	ug/l
B2EHP	BIS (2-ETHYLHEXYL) PHTHALATE	0.62	ug/g	4.8	ug/l
BAANTR	BENZO [A] ANTHRACENE	0.17	ug/g	1.6	ug/l
BAPYR	BENZO [A] PYRENE	0.25	ug/g	4.7	ug/l
BBFANT	BENZO [B] FLUORANTHENE	0.21	ug/g	5.4	ug/l
BBZP	BUTYLBENZYL PHTHALATE	0.17	ug/g	3.4	ug/l
BGHIPY	BENZO [G,H,I] PERYLENE	0.25	ug/g	6.1	ug/l
BKFANT	BENZO [K] FLUORANTHENE	0.066	ug/g	0.87	ug/l
BZALC	BENZYL ALCOHOL	0.19	ug/g	0.72	ug/l
CARBAZ	CARBAZOLE	No certified limit		No certified limit	
CHRY	CHRYSENE	0.12	ug/g	2.4	ug/l
CL6BZ	HEXACHLOROBENZENE	0.033	ug/g	1.6	ug/l
CL6CP	HEXACHLOROCYCLOPNTADIENE	6.2	ug/g	8.6	ug/l
CL6ET	HEXACHLOROETHANE	0.15	ug/g	1.5	ug/l
DBAHA	DIBENZ [A,H] ANTHRACENE	0.21	ug/g	6.5	ug/l
DBZFUR	DIBENZOFURAN	0.035	ug/g	1.7	ug/l
DEP	DIETHYL PHTHALATE	0.24	ug/g	2	ug/l
DMP	DIMETHYL PHTHALATE	0.17	ug/g	1.5	ug/l

continued

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
DNBP	DI-N-BUTYL PHTHALATE	0.061	ug/g	3.7	ug/l
DNOP	DI-N-OCTYL PHTHALATE	0.19	ug/g	15	ug/l
FANT	FLUORANTHENE	0.068	ug/g	3.3	ug/l
FLRENE	FLUORENE	0.033	ug/g	3.7	ug/l
HCBD	HEXACHLOROBUTADIENE	0.23	ug/g	3.4	ug/l
ICDPYR	INDENO [1,2,3-C,D] PYRENE	0.29	ug/g	8.6	ug/l
ISOPHR	ISOPHORONE	0.033	ug/g	4.8	ug/l
NAP	NAPHTHALENE	0.037	ug/g	0.5	ug/l
NB	NITROBENZENE	0.045	ug/g	0.5	ug/l
NNDNPA	N-NITROSO DI-N-PROPYLAMINE	0.2	ug/g	4.4	ug/l
NNDPA	N-NITROSO DIPHENYLAMINE	0.19	ug/g	3	ug/l
PCP	PENTACHLOROPHENOL	1.3	ug/g	18	ug/l
PHANTR	PHENANTHRENE	0.033	ug/g	0.5	ug/l
PHENOL	PHENOL	0.11	ug/g	9.2	ug/l
PYR	PYRENE	0.033	ug/g	2.8	ug/l
PAL ORGANICS PESTICIDES AND PCBS					
ABHC	ALPHA-BENZENEHEXACHLORIDE/ ALPHA-HEXACHLOROCYCLOHEXANE	0.00907	ug/g	0.0385	ug/l
ACLDAN	ALPHA CHLORDANE	0.005	ug/g	0.075	ug/l

continued

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
AENSLF	ALPHA-ENDOSULFAN/ENDOSULFAN I	0.00602	ug/g	0.023	ug/l
ALDRN	ALDRIN	0.00729	ug/g	0.0918	ug/l
BBHC	BETA-BENZENEHEXACHLORIDE/ BETA-HEXACHLOROCYCLOHEXANE	0.00257	ug/g	0.024	ug/l
BENSLF	BETA-ENDOSULFAN/ENDOSULFAN II	0.00663	ug/g	0.023	ug/l
DBHC	DELTA-BENZENEHEXACHLORIDE/ DELTA-HEXACHLOROCYCLOHEXANE	0.00555	ug/g	0.0293	ug/l
DLDRN	DIELDRIN	0.00629	ug/g	0.024	ug/l
ENDRN	ENDRIN	0.00657	ug/g	0.0238	ug/l
ENDRNA	ENDRIN ALDEHYDE	0.024	ug/g	0.0285	ug/l
ENDRNK	ENDRIN KETONE	Not certified		Not certified	
ESFS04	ENDOSULFAN SULFATE	0.00763	ug/g	0.0786	ug/l
GCLDAN	GAMA-CHLORDANE	0.005	ug/g	0.075	ug/l
HPCL	HEPTACHLOR	0.00618	ug/g	0.0423	ug/l
HPCLE	HEPTACHLOR EPOXIDE	0.0062	ug/g	0.0245	ug/l
LIN	LINDANE/GAMMA-BENZENEHEXACHLORIDE/ GAMMA-HEXACHLOROCYCLOHEXANE	0.00638	ug/g	0.0507	ug/l
MEXCLR	METHOXYCHLOR	0.0711	ug/g	0.057	ug/l
PCB016	PCB 1016	0.0666	ug/g	0.16	ug/l
PCB221	PCB 1221	0.0666	ug/g	0.16	ug/l

continued

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

TEST NAME	PARAMETER NAME	SOIL		WATER	
		CRL	UNIT	CRL	UNIT
PCB232	PCB 1232	0.0666	ug/g	0.16	ug/l
PCB242	PCB 1242	0.0804	ug/g	0.19	ug/l
PCB248	PCB 1248	0.0804	ug/g	0.19	ug/l
PCB254	PCB 1254	0.0804	ug/g	0.19	ug/l
PCB260	PCB 1260	0.0804	ug/g	0.19	ug/l
PPDDD	2,2-BIS (PARA-CHLOROPHENYL)-1,1DICHLOROETHANE	0.00826	ug/g	0.0233	ug/l
PPDDE	2,2-BIS (PARA-CHLOROPHENYL)-1,1-DICHLOROETHENE	0.00765	ug/g	0.027	ug/l
PPDDT	2,2-BIS (PARA-CHLOROPHENYL)-1,1,1-TRICHLOROETHANE	0.00707	ug/g	0.034	ug/l
TXPHEN	TOXAPHENE	0.444	ug/g	1.35	ug/l

Notes:

CRL = Certified Reporting Limit
NA = Not Applicable

APPENDIX K

BACKGROUND DATA RATIONALE

INTRODUCTION

On 10 September 1993, representatives from Ecology and Environment, Inc. (E & E), Arthur D. Little (ADL), ABB Engineering Services (ABB), and the U.S. Army Environmental Center (USAEC) met at ADL's office in Cambridge, MA to discuss methods for determining background concentrations of organic and inorganic analytes in groundwater, soil, sediment, and surface water at Fort Devens. The objective of the meeting was to initiate the development of a uniform set of background values that could be used by all contractors to identify organic and inorganic contamination at the base. This appendix summarizes the current background values being used for this report, incorporating data from all available sources.

Appendix K is divided into three sections based on matrix. The sections are:

- Section K1: Background Concentrations of Inorganic Analytes in Sediment;
- Section K2: Background Concentrations of Inorganic Analytes in Soil and Background Concentrations of Organic Analytes in soil; and
- Section K3: Background Concentrations of Inorganic Analytes in Surface Water.

Background concentration ranges for inorganic analytes in each matrix were determined from designated background samples collected at Fort Devens. The background sediment database was augmented with regional data from the peer-reviewed scientific literature. The background surface-water database was augmented with additional surface-water samples from IRDMIS.

There are no background data for groundwater on a regional scale from areas known to be unaffected by human activity. Wells that are upgradient of specific sites, such as 32M-92-01X at the DRMO Yard, have been compared with on-site wells.

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SECTION K2

Background Concentrations of Inorganic Analytes in Soil

Background soil samples for inorganic analytes were collected in August 1991, October 1992, and June 1993. Thirty-three samples in all were collected. The samples were collected from all three of the major soil associations on the base and from each of Main Post, North Post, and South Post. Sample locations are shown in Figure K2-1. Note that no AOCs occur on the fourth soil association mapped, which lies outside the present boundaries of the facility. The background soil samples were all collected from sites that were, as far as could be determined visually, undisturbed, that were at least 50 feet from any road and at least 300 feet from any known or suspected Study Area. In most cases the distance was greater, especially in South Post.

Table K2-1 is the background database for inorganic analytes in soil. Sampling date, post, and soil association are listed for the samples. There are two columns in the table for each analyte: one column for the measured concentration and one for notes. The note column indicates which data points were entered as one-half the LOD and which are outliers. For calculation purposes, values that appeared in IRDMIS as less than the LOD were converted to one-half the LOD. Outliers were identified by the method of Dixon or Grubbs as described by Sokal and Rohlf (1981), graphically, or by judgment. Dixon's test is valid for sample sizes of 3 to 25. Grubbs' test was used for sample sizes greater than 25.

Grubbs' method was applied to the data for the following sixteen analytes: aluminum, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc. Dixon's test for outliers was applied to the data for beryllium, cobalt, and selenium after omitting 10 samples for beryllium, 10 samples for cobalt, and 20 samples for selenium that were reported as less than the LOD, but that had unusually high LODs. For example, 10 samples had a reported cobalt concentration of < 14 mg/kg (see Table K2-1); this LOD is greater than the highest measured value for cobalt of 4.69 mg/kg.

Outliers for mercury were determined graphically. A normal probability plot showed the mercury data to be bimodally distributed; the four values in the upper cluster were judged to be outliers (see Table K2-1). Silver was detected in only two background soil samples; the "detects" were judged to be outliers (see Table K2-1). In all, 35 outliers were identified in the background soil database.

Table K2-2 lists concentration ranges for inorganic analytes for the Fort Devens background soil database, excluding outliers. Inorganic analyte levels in AOC samples were compared with the maximum of the background range; exceedances were considered site-related contamination. For comparison, Table K2-2 also lists concentration ranges for inorganic analytes in uncontaminated soils of the eastern United States. For all analytes, the maximum concentration in the Fort Devens background database lies within the range for the eastern United States, usually toward the low end of the range. This suggests that comparing

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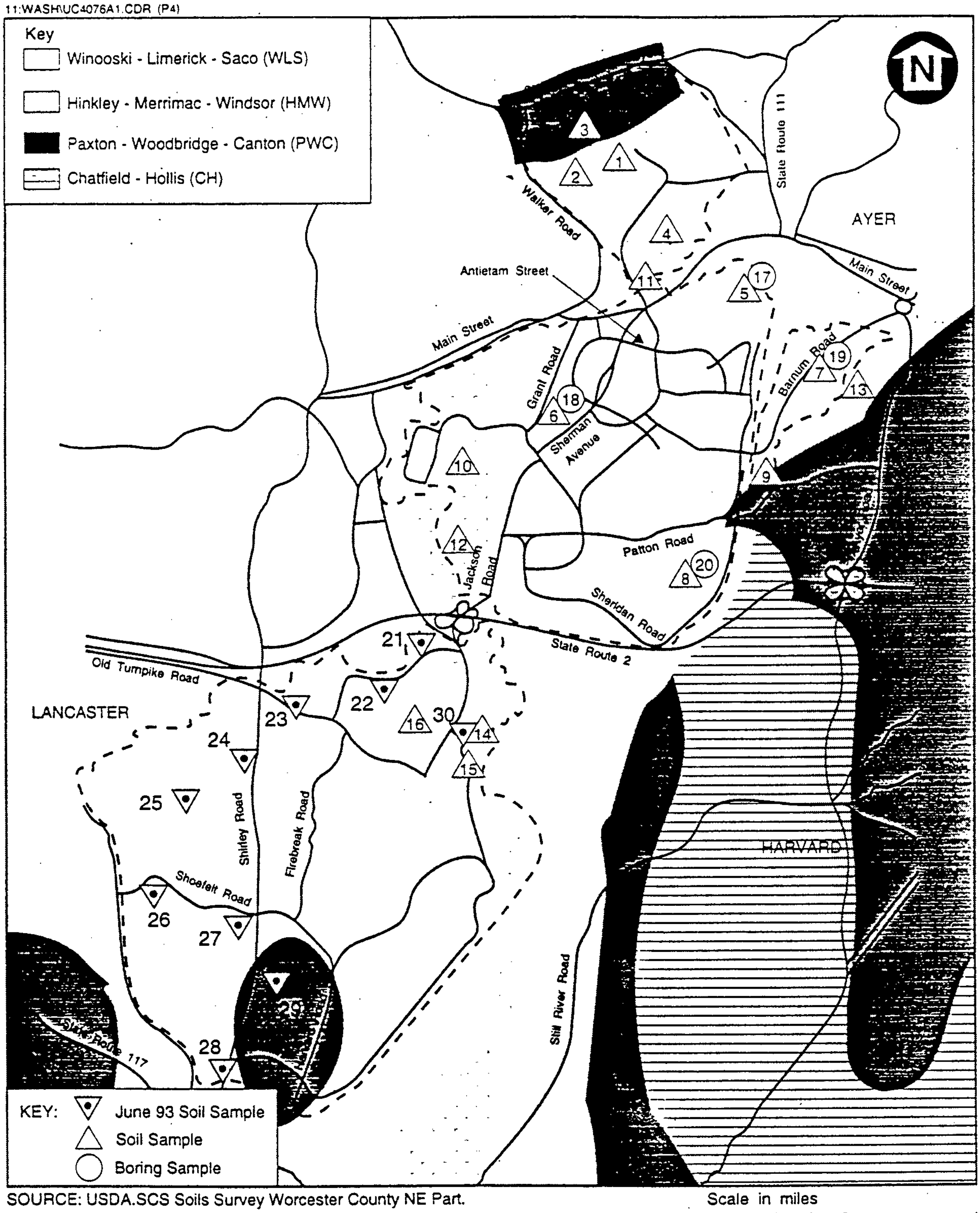

SOURCE: USDA.SCS Soils Survey Worcester County NE Part.

Scale in miles
1 3/4 1/2 1/4 0

Legend —— Road - - - Installation Boundary.

Figure K2-1 BACKGROUND SAMPLING SITES FOR SOIL

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TABLE K2-1. BACKGROUND DATABASE FOR INORGANIC ANALYTES IN SOIL AT FORT DEVENS. ALL VALUES ARE mg/kg.

SAMP_ID$	DATE$	POST$	ASSOC$	TYPE$	AL	ALNOTE$	SB	SBNOTE$	AS	ASNOTE$	BA	BANOTE$	BE	BENOTE$	CD	CDNOTE$	CA	CANOTE$	CR	CRNOTE$
SOIL-01	AUG91	NORTH	HMW	AREA	6400		1.71	1/2 LOD	9.6		14.2		0.119		0.212	1/2 LOD	610		7.11	
SOIL-02	AUG91	NORTH	HMW	AREA	14000		17	1/2 LOD	13		35		0.126		0.212	1/2 LOD	610		11.1	
SOIL-03	AUG91	NORTH	FWC	AREA	12000		1.71	1/2 LOD	9.3		14.5		0.039		0.212	1/2 LOD	330		7.57	
SOIL-04	AUG91	NORTH	WLS	AREA	8800		1.71	1/2 LOD	9.4		14.2		0.141		0.212	1/2 LOD	630		10.2	
SOIL-05	AUG91	MAIN	HMW	AREA	9900		1.71	1/2 LOD	12		15.5		0.124		0.212	1/2 LOD	430		8.2	
SOIL-06	AUG91	MAIN	HMW	AREA	13000		1.71	1/2 LOD	32	OUTLIER	11.5	1/2 LOD	0.108		1.28		710		30.3	
SOIL-07	AUG91	MAIN	HMW	AREA	12000		1.71	1/2 LOD	15		36		0.133		1.06		1400	OUTLIER	29	
SOIL-08	AUG91	MAIN	HMW	AREA	2500	1/2 LOD	1.71	1/2 LOD	15		15.6		0.142		0.212	1/2/LOD	310		9.59	
SOIL-09	AUG91	MAIN	FWC	AREA	24000	OUTLIER	17	1/2 LOD	25	OUTLIER	54		0.335		1.06		650	1/2 LOD	56.5	OUTLIER
SOIL-10	AUG91	MAIN	WLS	AREA	8500		17	1/2 LOD	14		11.5	1/2 LOD	0.390	1/2 LOD	2.1	1/2 LOD	2100	OUTLIER	19.5	1/2 LOD
SOIL-11	AUG91	MAIN	WLS	AREA	11000		1.71	1/2 LOD	13		52		0.350		4.48	OUTLIER	2800	OUTLIER	27.1	
SOIL-12	AUG91	MAIN	WLS	AREA	7400		1.71	1/2 LOD	7.1		12.9		0.172		0.212	1/2 LOD	810		6.02	
SOIL-13	AUG91	MAIN	HMW	AREA	18000		1.71	1/2 LOD	28	OUTLIER	67.2	OUTLIER	0.672		3.52	OUTLIER	1500	1/2 LOD	33	
SOIL-14	AUG91	SOUTH	WLS	AREA	6900		1.71	1/2 LOD	11		16.6		0.146		0.212	1/2 LOD	740		13.8	
SOIL-15	AUG91	SOUTH	WLS	AREA	8000		1.71	1/2 LOD	4.6		16.2		0.145		0.212	1/2 LOD	144		1.95	1/2 LOD
SOIL-16	AUG91	SOUTH	FWC	AREA	13000		1.71	1/2 LOD	11		46		0.533		0.212	1/2 LOD	720		12.5	
SOIL-17	AUG91	MAIN	HMW	BORE	4300		1.71	1/2 LOD	9.5		9.67		0.039	1/2 LOD	0.212	1/2 LOD	350		7.71	
SOIL-18	AUG91	MAIN	HMW	BORE	11000		1.71	1/2 LOD	99	OUTLIER	29		0.039		0.212	1/2 LOD	650		39.5	OUTLIER
SOIL-19	AUG91	MAIN	HMW	BORE	7100		1.71	1/2 LOD	11		14.2		0.104		0.212	1/2 LOD	710		14.1	
SOIL-20	AUG91	MAIN	HMW	BORE	7100		1.71	1/2 LOD	19		31		0.188		0.212	1/2 LOD	810		9.25	
BKS-21	JUN93	SOUTH	FWC	AREA	7800		0.25	1/2 LOD	7.03		21.4		0.25	1/2 LOD	0.602		250	1/2 LOD	7.13	
BKS-22	JUN93	SOUTH	FWC	AREA	9600		0.25	1/2 LOD	7.8		15		0.25	1/2 LOD	0.647		250	1/2 LOD	10.6	
BKS-23	JUN93	SOUTH	HMW	AREA	9800		0.25	1/2 LOD	11.0		11.8		0.25	1/2 LOD	0.551		250	1/2 LOD	10.4	
BKS-24	JUN93	SOUTH	HMW	AREA	7400		0.25	1/2 LOD	14.4		12.3		0.25	1/2 LOD	1.21		250	1/2 LOD	12.5	
BKS-25	JUN93	SOUTH	HMW	AREA	387		0.25	1/2 LOD	6.04		2.5	1/2 LOD	0.25	1/2 LOD	0.25	1/2 LOD	250	1/2 LOD	1.0	1/2 LOD
BKS-26	JUN93	SOUTH	HMW	AREA	1800		0.25	1/2 LOD	8.31		2.5	1/2 LOD	0.25	1/2 LOD	0.25	1/2 LOD	250	1/2 LOD	2.67	
BKS-27	JUN93	SOUTH	HMW	AREA	797		0.25	1/2 LOD	5.19		2.5	1/2 LOD	0.25	1/2 LOD	0.25	1/2 LOD	250	1/2 LOD	1.0	1/2 LOD
BKS-28	JUN93	SOUTH	WLS	AREA	398		0.25	1/2 LOD	2.06		2.5	1/2 LOD	0.25	1/2 LOD	0.25	1/2 LOD	250	1/2 LOD	1.0	1/2 LOD
BKS-29	JUN93	SOUTH	FWC	AREA	1460		0.25	1/2 LOD	8.04		2.5	1/2 LOD	0.25	1/2 LOD	0.25	1/2 LOD	250	1/2 LOD	1.0	1/2 LOD
BKS-30	JUN93	SOUTH	WLS	AREA	603		0.25	1/2 LOD	3.3		2.5	1/2 LOD	0.25	1/2 LOD	0.25	1/2 LOD	250	1/2 LOD	1.0	1/2 LOD
25S-92-12X	OCT92	SOUTH			2920		0.55	1/2 LOD	3.17		18		0.25	1/2 LOD	0.35	1/2 LOD	50	1/2 LOD	2.03	1/2 LOD
25S-92-13X	OCT92	SOUTH			11400		0.55	1/2 LOD	7.87		28		0.81		0.35	1/2 LOD	50	1/2 LOD	9.43	
26S-92-10X	OCT92	SOUTH			7380		0.55	1/2 LOD	10.7		30.1		0.698		0.35	1/2 LOD	50	1/2 LOD	9.09	

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TABLE K2-1. CONTINUED.

SAMP_ID$	DATE$	POST$	ASSOC$	TYPE$	K	KNOTE$	SE	SENOTE$	AG	AGNOTE$	NA	NANOTE$	V	VNOTE$	ZN	ZNNOTE$
SOIL-01	AUG91	NORTH	HMW	AREA	620		2.88	1/2 LOD	0.043	1/2 LOD	26	1/2 LOD	7.57		16.5	
SOIL-02	AUG91	NORTH	HMW	AREA	660		2.88	1/2 LOD	0.043	1/2 LOD	58.6		16.6		27.7	
SOIL-03	AUG91	NORTH	FWC	AREA	530		2.88	1/2 LOD	0.043	1/2 LOD	26	1/2 LOD	17.9		14.6	
SOIL-04	AUG91	NORTH	WLS	AREA	314		2.88	1/2 LOD	0.043	1/2 LOD	26	1/2 LOD	11.7		13.6	
SOIL-05	AUG91	MAIN	HMW	AREA	470		2.88	1/2 LOD	0.043	1/2 LOD	71.2		7.91		14.7	
SOIL-06	AUG91	MAIN	HMW	AREA	1100		2.88	1/2 LOD	0.208	OUTLIER	79.8		32.3		40	1/2 LOD
SOIL-07	AUG91	MAIN	HMW	AREA	1700		2.88	1/2 LOD	0.043	1/2 LOD	117		23.4		40	1/2 LOD
SOIL-08	AUG91	MAIN	HMW	AREA	630		2.88	1/2 LOD	0.043	1/2 LOD	26	1/2 LOD	8.03		13.2	
SOIL-09	AUG91	MAIN	FWC	AREA	2400		2.88	1/2 LOD	0.043	1/2 LOD	85.8		44.3	OUTLIER	130	OUTLIER
SOIL-10	AUG91	MAIN	WLS	AREA	990		2.88	1/2 LOD	0.043	1/2 LOD	680	OUTLIER	6.5	1/2 LOD	40	1/2 LOD
SOIL-11	AUG91	MAIN	WLS	AREA	1100		2.88	1/2 LOD	0.582	OUTLIER	123		18.1		40	1/2 LOD
SOIL-12	AUG91	MAIN	WLS	AREA	600		2.88	1/2 LOD	0.043	1/2 LOD	26	1/2 LOD	16.3		17.7	
SOIL-13	AUG91	MAIN	HMW	AREA	2200		2.88	1/2 LOD	0.043	1/2 LOD	231		46.6	OUTLIER	40	1/2 LOD
SOIL-14	AUG91	SOUTH	WLS	AREA	700		2.88	1/2 LOD	0.043	1/2 LOD	100		13.8		22.2	
SOIL-15	AUG91	SOUTH	WLS	AREA	248		2.88	1/2 LOD	0.043	1/2 LOD	26	1/2 LOD	6.19		11.7	
SOIL-16	AUG91	SOUTH	FWC	AREA	2400		2.88	1/2 LOD	0.043	1/2 LOD	130		17.5		23.4	
SOIL-17	AUG91	MAIN	HMW	BORE	590		2.88	1/2 LOD	0.043	1/2 LOD	57.5		6.12		11.2	
SOIL-18	AUG91	MAIN	HMW	BORE	1700		2.88	1/2 LOD	0.043	1/2 LOD	124		22.8		40	1/2 LOD
SOIL-19	AUG91	MAIN	HMW	BORE	880		2.88	1/2 LOD	0.043	1/2 LOD	86.7		9.89		14.2	
SOIL-20	AUG91	MAIN	HMW	BORE	1000		2.88	1/2 LOD	0.043	1/2 LOD	93.9		7.2		13.5	
BKS-21	JUN93	SOUTH	FWC	AREA	341		0.1	1/2 LOD	0.1	1/2 LOD	100	1/2 LOD	10.5		43.9	
BKS-22	JUN93	SOUTH	FWC	AREA	100	1/2 LOD	0.1	1/2 LOD	0.1	1/2 LOD	100	1/2 LOD	11.4		32.3	
BKS-23	JUN93	SOUTH	HMW	AREA	100	1/2 LOD	0.1	1/2 LOD	0.1	1/2 LOD	100	1/2 LOD	10.5		28.7	
BKS-24	JUN93	SOUTH	HMW	AREA	100	1/2 LOD	0.603		0.1	1/2 LOD	100	1/2 LOD	28.5		35.2	
BKS-25	JUN93	SOUTH	HMW	AREA	100	1/2 LOD	0.279		0.1	1/2 LOD	100	1/2 LOD	1.0	1/2 LOD	3.69	
BKS-26	JUN93	SOUTH	HMW	AREA	100	1/2 LOD	0.489		0.1	1/2 LOD	100	1/2 LOD	1.0	1/2 LOD	5.26	
BKS-27	JUN93	SOUTH	HMW	AREA	100	1/2 LOD	0.388		0.1	1/2 LOD	100	1/2 LOD	1.0	1/2 LOD	5.33	
BKS-28	JUN93	SOUTH	WLS	AREA	100	1/2 LOD	0.246		0.1	1/2 LOD	100	1/2 LOD	1.0	1/2 LOD	3.52	
BKS-29	JUN93	SOUTH	FWC	AREA	100	1/2 LOD	0.33		0.1	1/2 LOD	100	1/2 LOD	3.3		7.8	
BKS-30	JUN93	SOUTH	WLS	AREA	100	1/2 LOD	0.1	1/2 LOD	0.1	1/2 LOD	100	1/2 LOD	1.0	1/2 LOD	4.87	
25S-92-12X	OCT92	SOUTH			215	BK	0.601		0.29	1/2 LOD	208		4.7		4.015	1/2 LOD
25S-92-13X	OCT92	SOUTH			260	BK	1.23	OUTLIER	0.29	1/2 LOD	191		13.3		25.3	
26S-92-10X	OCT92	SOUTH			143	BU	0.992		0.29	1/2 LOD	234		19.8		33.3	

Table K2-3

PESTICIDE CONCENTRATION RANGES
FORT DEVENS MAIN POST SITE INVESTIGATION

Compounds	Total Samples	Total Detects	Minimum Detect	Maximum Detect	Average	95th Percentile (3)	Approximate Range of Detection Limits (2)
Soils							
Chlordane	241	1	0.136	0.136	0.136	-	0.04 - 1
p,p'-DDD	719 (1)	40	0.004	6.6	0.53	2.85	0.003 - 0.27
p,p'-DDE	726 (1)	70	0.003	2.7	0.10	0.76	0.003 - 0.31
p,p'-DDT	727 (1)	148	0.004	5.6	0.25	1.53	0.004 - 0.41
Sediments							
Chlordane	97	0	-	-	-	-	0.016 - 1
p,p'-DDD	444	77	0.008	6.2	0.39	2.25	0.008 - 2
p,p'-DDE	449	81	0.003	1.3	0.092	0.44	0.004 - 2
p,p'-DDT	449	50	0.009	15	0.42	4.66	0.004 - 2

* Composite of results from multiple data sets of Level III data for non-entomology shop locations at Main, South, and North Posts, Fort Devens, Massachusetts.

All results in mg/kg (ppm).

(1) Sample set with higher detection limit of three removed from data set (total of six samples).
(2) Only includes detection limits for results reported in database as "LT".
(3) 95th percentile formula - mean + (2 x standard deviations) for all detected results.

Source: ADL 1993.

C4081/RC1123_FAII_V4-08/27/94-F1

U.S. Army
Environmental
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Remedial Investigations Report Functional Area II Volume IV of IV Appendices

Fort Devens, Massachusetts

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1700 North Moore Street
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CALCULATION OF BACKGROUND CONCENTRATIONS

TABLE L-1
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

SOIL		GROUNDWATER	
Analyte	Concentration µg/g	Analyte	Concentration µg/L
Aluminum	18000	Aluminum	6870
Antimony	0.5	Antimony	3.03
Arsenic	19	Arsenic	10.5
Barium	54	Barium	39.6
Beryllium	0.81	Beryllium	5
Cadmium	1.28	Cadmium	4.01
Calcium	810	Calcium	14700
Chromium	33	Chromium	14.7
Cobalt	4.7	Cobalt	25
Copper	13.5	Copper	8.09
Iron	18000	Iron	9100
Lead	48	Lead	4.25
Magnesium	5500	Magnesium	3480
Manganese	380	Manganese	291
Mercury	--	Mercury	0.243
Nickel	14.6	Nickel	34.3
Potassium	2400	Potassium	2370
Selenium	--	Selenium	3.02
Silver	0.086	Silver	4.6
Sodium	131	Sodium	10800
Thallium	--	Thallium	6.99
Vanadium	32.3	Vanadium	11
Zinc	43.9	Zinc	21.1

GROUNDWATER BACKGROUND CONCENTRATIONS
REPRESENTATIVE SAMPLES
FORT DEVENS, MASSACHUSETTS

MONITORING WELL	LOCATION	TOTAL SUSPENDED SOLIDS (ug/L)	ALUMINUM (ug/L)
G6M-92-09X	NORTH POST	37,000	230
G6M-92-11X	NORTH POST	53,000	1,920
WWTMW-01	NORTH POST	20,000	2,330
WWTMW-13	NORTH POST	30,000	3,150
WWTMW-14	NORTH POST	25,000	9,130
G3M-92-01X	MAIN POST	<4,000	71
13M-92-01X	MAIN POST	–	7,270
12M-92-01X	SOUTH POST	–	179
27M-92-04X	SOUTH POST	–	8,700
28M-92-01X	SOUTH POST	–	2,280

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INORGANIC ANALYTES IN WATER
FORT DEVENS, MASSACHUSETTS

DATA		CALCULATIONS	
ALUMINUM			
MONITORING WELL	CONCENTRATION (ug/L)		
G3M-92-01X	71	Minimum -	71
12M-92-01X	179	Maximum -	9140
G6M-92-09X	230		
G6M-92-11X	1920	Mean -	3527
28M-92-01X	2280		
WWTMW-01	2330	95th %ile -	6874
WWTMW-13	3150		
13M-92-01X	7270		
27M-92-04X	8700	Background Concentration -	6870
WWTMW-14	9140		
ANTIMONY			
MONITORING WELL	CONCENTRATION (ug/L)		
WWTMW-14	1.52	Minimum -	1.52
WWTMW-13	1.52	Maximum -	1.52
WWTMW-01	1.52		
G6M-92-11X	1.52	Mean -	1.52
G6M-92-09X	1.52		
G3M-92-01X	1.52	95th %ile -	NA
28M-92-01X	1.52		
27M-92-04X	1.52		
13M-92-01X	1.52	Background Concentration -	3.03 *
12M-92-01X	1.52		
ARESNIC			
MONITORING WELL	CONCENTRATION (ug/L)		
G6M-92-11X	1.27	Minimum -	1.27
12M-92-01X	1.27	Maximum -	15.20
G6M-92-09X	1.27		
G3M-92-01X	1.77	Mean -	5.65
28M-92-01X	3.94		
WWTMW-13	5.39	95th %ile -	10.5
WWTMW-01	9.81		
13M-92-01X	10.9		
WWTMW-14	15.2	Background Concentration -	10.5
27M-92-04X	32.3 **		
BARIUM			
MONITORING WELL	CONCENTRATION (ug/L)		
12M-92-01X	2.5	Minimum -	2.5
G6M-92-09X	7.6	Maximum -	52.0
G3M-92-01X	10.7		
WWTMW-01	12.4	Mean -	22.6
28M-92-01X	14.4		
G6M-92-11X	16.1	95th %ile -	39.6
WWTMW-13	19.5		
13M-92-01X	44.5		
WWTMW-14	46.3	Background Concentration -	39.6
27M-92-04X	52.0		

* Method Detection Limit
** Likely Statistical Outlier

INORGANIC ANALYTES IN WATER
FORT DEVENS, MASSACHUSETTS

BERYLLIUM

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
G3M-92-01X	2.50	Minimum –	2.50
12M-92-01X	2.50	Maximum –	2.50
G6M-92-09X	2.50		
G6M-92-11X	2.50	Mean –	2.50
28M-92-01X	2.50		
WWTMW-01	2.50	95th %ile –	NA
WWTMW-13	2.50		
13M-92-01X	2.50	Background Concentration –	5.00 *
27M-92-04X	2.50		
WWTMW-14	2.50		

CADMIUM

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
WWTMW-14	2.01	Minimum –	2.01
WWTMW-13	2.01	Maximum –	2.01
WWTMW-01	2.01		
G6M-92-11X	2.01	Mean –	2.01
G6M-92-09X	2.01		
G3M-92-01X	2.01	95th %ile –	NA
28M-92-01X	2.01		
27M-92-04X	2.01	Background Concentration –	4.01 *
13M-92-01X	2.01		
12M-92-01X	2.01		

CALCIUM

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
12M-92-01X	179	Minimum –	179
28M-92-01X	1910	Maximum –	23200
WWTMW-14	2490		
WWTMW-13	3280	Mean –	7801
G6M-92-11X	5780		
WWTMW-01	6940	95th %ile –	14747
G3M-92-01X	7710		
27M-92-04X	8820	Background Concentration –	14700
G6M-92-09X	17700		
13M-92-01X	23200		

CHROMIUM

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
G3M-92-01X	3.01	Minimum –	3.0
G6M-92-09X	3.01	Maximum –	18.7
28M-92-01X	3.01		
12M-92-01X	3.01	Mean –	8.7
WWTMW-01	6.04		
G6M-92-11X	6.36	95th %ile –	14.7
WWTMW-13	10.1		
27M-92-04X	16.4	Background Concentration –	14.7
13M-92-01X	16.9		
WWTMW-14	18.7		

* Method Detection Limit
** Likely Statistical Outlier

INORGANIC ANALYTES IN WATER
FORT DEVENS, MASSACHUSETTS

DATA | CALCULATIONS

COBALT

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
G3M-92-01X	12.5	Minimum –	12.5
12M-92-01X	12.5	Maximum –	12.5
G6M-92-09X	12.5	Mean –	12.5
G6M-92-11X	12.5	95th %ile –	NA
28M-92-01X	12.5	Background Concentration –	25.0 *
WWTMW-01	12.5		
WWTMW-13	12.5		
13M-92-01X	12.5		
27M-92-04X	12.5		
WWTMW-14	12.5		

COPPER

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
G3M-92-01X	4.05	Minimum –	4.05
WWTMW-14	4.05	Maximum –	6.52
28M-92-01X	4.05	Mean –	4.36
WWTMW-01	4.05	95th %ile –	5.2
G6M-92-09X	4.05	Background Concentration –	8.09 *
12M-92-01X	4.05		
G6M-92-11X	4.05		
WWTMW-13	6.52		
13M-92-01X	18.60 **		
27M-92-04X	19.00 **		

IRON

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
G3M-92-01X	171	Minimum –	171
G6M-92-09X	331	Maximum –	12900
12M-92-01X	373	Mean –	4611
G6M-92-11X	2390	95th %ile –	9104
28M-92-01X	2410	Background Concentration –	9100
WWTMW-01	3250		
WWTMW-13	3830		
WWTMW-14	9250		
27M-92-04X	11200		
13M-92-01X	12900		

LEAD

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
G6M-92-09X	0.65	Minimum –	0.65
WWTMW-01	2.00	Maximum –	5.70
28M-92-01X	2.17	Mean –	2.81
G3M-92-01X	2.30	95th %ile –	4.25
G6M-92-11X	2.30	Background Concentration –	4.25
WWTMW-13	3.10		
12M-92-01X	4.23		
WWTMW-14	5.70		
13M-92-01X	12.10 **		
27M-92-04X	12.40 **		

* Method Detection Limit
** Likely Statistical Outlier

INORGANIC ANALYTES IN WATER
FORT DEVENS, MASSACHUSETTS

DATA		CALCULATIONS	
MAGNESIUM			
MONITORING WELL	CONCENTRATION (ug/L)		
28M-92-01X	693	Minimum –	693
G6M-92-11X	857	Maximum –	4500
G3M-92-01X	1000		
WWTMW-13	1390	Mean –	2157
G6M-92-09X	1600		
WWTMW-01	1900	95th %ile –	3477
WWTMW-14	1970		
27M-92-04X	3550		
12M-92-01X	4110	Background Concentration –	3480
13M-92-01X	4500		
MANGANESE			
MONITORING WELL	CONCENTRATION (ug/L)		
G6M-92-09X	23.4	Minimum –	23.40
12M-92-01X	69.9	Maximum –	486.00
WWTMW-01	77.7		
28M-92-01X	86.4	Mean –	156.93
G6M-92-11X	102		
WWTMW-13	107	95th %ile –	290.7
13M-92-01X	227		
WWTMW-14	233		
G3M-92-01X	486	Background Concentration –	291
27M-92-04X	1110 **		
MERCURY			
MONITORING WELL	CONCENTRATION (ug/L)		
WWTMW-01	0.12	Minimum –	0.12
G3M-92-01X	0.12	Maximum –	0.70
12M-92-01X	0.12		
13M-92-01X	0.12	Mean –	0.18
WWTMW-14	0.12		
28M-92-01X	0.12	95th %ile –	0.35
G6M-92-11X	0.12		
G6M-92-09X	0.12		
27M-92-04X	0.12	Background Concentration –	0.243 *
WWTMW-13	0.70		
NICKEL			
MONITORING WELL	CONCENTRATION (ug/L)		
G6M-92-09X	17.2	Minimum –	17.20
WWTMW-01	17.2	Maximum –	17.20
28M-92-01X	17.2		
G3M-92-01X	17.2	Mean –	17.20
G6M-92-11X	17.2		
WWTMW-13	17.2	95th %ile –	NA
12M-92-01X	17.2		
WWTMW-14	17.2		
13M-92-01X	17.2	Background Concentration –	34.3 *
27M-92-04X	17.2		

* Method Detection Limit
** Likely Statistical Outlier

INORGANIC ANALYTES IN WATER
FORT DEVENS, MASSACHUSETTS

DATA		CALCULATIONS	
POTASSIUM			
MONITORING WELL	CONCENTRATION (ug/L)		
28M-92-01X	461	Minimum -	461
G6M-92-11X	645	Maximum -	2790
WWTMW-13	1080		
G3M-92-01X	1450	Mean -	1644
12M-92-01X	1500		
WWTMW-01	1980	95th %ile -	2370
WWTMW-14	1980		
G6M-92-09X	1980	Background Concentration -	2370
13M-92-01X	2570		
27M-92-04X	2790		
SELENIUM			
MONITORING WELL	CONCENTRATION (ug/L)		
G6M-92-09X	1.51	Minimum -	1.51
12M-92-01X	1.51	Maximum -	1.51
WWTMW-01	1.51		
28M-92-01X	1.51	Mean -	1.51
G6M-92-11X	1.51		
WWTMW-13	1.51	95th %ile -	NA
13M-92-01X	1.51		
WWTMW-14	1.51	Background Concentration -	3.02 *
G3M-92-01X	1.51		
27M-92-04X	1.51		
SILVER			
MONITORING WELL	CONCENTRATION (ug/L)		
WWTMW-01	2.30	Minimum -	2.30
G3M-92-01X	2.30	Maximum -	2.30
12M-92-01X	2.30		
13M-92-01X	2.30	Mean -	2.30
WWTMW-14	2.30		
28M-92-01X	2.30	95th %ile -	NA
G6M-92-11X	2.30		
G6M-92-09X	2.30	Background Concentration -	4.60 *
27M-92-04X	2.30		
WWTMW-13	2.30		
SODIUM			
MONITORING WELL	CONCENTRATION (ug/L)		
28M-92-01X	1380	Minimum -	1380
G6M-92-09X	2000	Maximum -	18000
WWTMW-14	2100		
G6M-92-11X	2430	Mean -	5771
27M-92-04X	3070		
12M-92-01X	4250	95th %ile -	10841
WWTMW-13	4610		
G3M-92-01X	8570	Background Concentration -	10800
WWTMW-01	11300		
13M-92-01X	18000		

* Method Detection Limit
** Likely Statistical Outlier

INORGANIC ANALYTES IN WATER
FORT DEVENS, MASSACHUSETTS

THALLIUM

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
28M-92-01X	3.50	Minimum -	3.50
G6M-92-11X	3.50	Maximum -	3.50
WWTMW-13	3.50		
G3M-92-01X	3.50	Mean -	3.50
12M-92-01X	3.50		
WWTMW-01	3.50	95th %ile -	3.50
WWTMW-14	3.50		
G6M-92-09X	3.50		
13M-92-01X	3.50	Background Concentration -	6.99
27M-92-04X	3.50		

VANADIUM

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
G6M-92-09X	5.50	Minimum -	5.50
12M-92-01X	5.50	Maximum -	14.50
WWTMW-01	5.50		
28M-92-01X	5.50	Mean -	7.13
G6M-92-11X	5.50		
WWTMW-13	5.50	95th %ile -	10.41
13M-92-01X	5.50		
G3M-92-01X	5.50		
27M-92-04X	12.8	Background Concentration -	11.0 *
WWTMW-14	14.5		

ZINC

MONITORING WELL	CONCENTRATION (ug/L)	CALCULATIONS	
WWTMW-13	10.6	Minimum -	10.6
G6M-92-09X	10.6	Maximum -	47.0
WWTMW-01	10.6		
28M-92-01X	10.6	Mean -	20.5
G6M-92-11X	10.6		
G3M-92-01X	10.6	95th %ile -	34.9
WWTMW-14	32.0		
27M-92-04X	41.7		
12M-92-01X	47.0	Background Concentration -	21.1 *
13M-92-01X	78.5 **		

* Method Detection Limit

** Likely Statistical Outlier

FIELD ANALYTICAL DATA AND OFF-SITE ANALYTICAL LABORATORY DATA

(Computer Diskette).

HUMAN HEALTH RISK ASSESSMENT

N-1 RISK CHARACTERIZATION FOR AREA 1

Risk Characterization for AOC 57 Area 1

Area 1 was investigated and addressed as part of the Area Requiring Environmental Evaluation (AREE) 70 investigation (ADL, 1995). This area underwent a soil removal action to address total petroleum hydrocarbon (TPHC) and polynuclear aromatic hydrocarbon (PAH) contamination from parking lot runoff. Although some residual TPHC and PAH concentrations remained in Area 1 soils after the removal action, the contamination was determined to be consistent with soil and sediment at stormwater outfall sediments throughout Devens. Therefore, Area 1 was recommended for no further action (Weston, 1998); the decision is to be formalized in the AOC 57 Record of Decision. However, in accordance with recent USEPA requirements for site closure, a no further action decision must be supported by the demonstration that a site does not pose an unacceptable risk for future unrestricted land use. The assessment of risks associated with unrestricted future land use at Area 1 is presented in this appendix; the assessment indicates that residual contamination at Area 1 does not pose an unacceptable risk for future unrestricted land use.

Methods

Consistent with USEPA guidance for evaluating unrestricted land use, risks were characterized for child and adult residents who are assumed to live at Area 1 in the future. Exposures to soil via incidental ingestion, dermal uptake, and particulate inhalation were evaluated. Exposures were quantified using the residential exposure scenarios described in Section 9.1.3. The exposure point concentrations used to quantify potential soil exposures at Area 1 are the maximum detected concentrations measured in the confirmatory soil samples (post-removal conditions) collected at Area 1. Tables 1 through 4 present the exposure parameters, intake equations, exposure point concentrations, and intake estimates.

Dose-response values were obtained from USEPA sources, as described in Section 9.1.4. The oral RfD for pyrene, and the inhalation RfD for naphthalene, were used as surrogate dose-response values for PAHs with no published values. Toxicity associated with petroleum compounds (e.g., EPH and VPH) was evaluated using dose-response values published the MADEP.

Results

As shown in the table below, the total resident cancer risk does not exceed the USEPA target cancer risk range of $1x10^{-6}$ to $1x10^{-4}$. The non-cancer hazard index values are below the USEPA threshold HI of 1. These results indicate that residual contamination at Area 1 does not pose a risk above USEPA risk limits for the unrestricted future land use.

Exposure pathway	Excess lifetime cancer risk	Hazard index
Adult		
Incidental ingestion	2E-05	0.002
Dermal contact	8E-06	0.001
Dust inhalation	2E-10	0.000002
Total	*3E-05*	*0.003*
Child		
Incidental ingestion	3E-05	0.02
Dermal contact	4E-05	0.02
Dust inhalation	1E-10	0.000001
Total	*7E-05*	*0.04*
Total Resident Risk	**1E-04**	**Not additive**

TABLE 1
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

13-Oct-99

August 1992

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.08	mg/cm^2
SURFACE AREA EXPOSED	SA	5,800	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

TABLE 1
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Benzo(a)anthracene	5.1	1.0E-06	0.13	6.2E-07	7.3E-01	8.2E-01	7.5E-07	5.1E-07	1.3E-06	6.58%
Benzo(a)pyrene	6.1	1.2E-06	0.13	7.4E-07	7.3E+00	8.2E+00	9.0E-06	6.1E-06	1.5E-05	78.66%
Benzo(b)fluoranthene	6.1	1.2E-06	0.13	7.4E-07	7.3E-01	8.2E-01	9.0E-07	6.1E-07	1.5E-06	7.87%
Benzo(k)fluoranthene	5.8	1.2E-06	0.13	7.0E-07	7.3E-02	8.2E-02	8.5E-08	5.8E-08	1.4E-07	0.75%
Chrysene	6.9	1.4E-06	0.13	8.4E-07	7.3E-03	8.2E-03	1.0E-08	6.9E-09	1.7E-08	0.09%
Indeno(1,2,3-cd)pyrene	4.7	9.5E-07	0.13	5.7E-07	7.3E-01	8.2E-01	6.9E-07	4.7E-07	1.2E-06	6.06%
					SUMMARY CANCER RISK		1E-05	8E-06	2E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Acenaphthene	5.42	3.2E-06	0.13	1.9E-06	2.0E-02	1.8E-02	1.6E-04	1.1E-04	2.7E-04	
Benzo(g,h,I)perylene	4.4	2.6E-06	0.13	1.55817E-06	3.0E-02	2.7E-02	8.6E-05	5.8E-05	1.4E-04	
Fluoranthene	14	8.2E-06	0.13	5.0E-06	4.0E-02	3.6E-02	2.1E-04	1.4E-04	3.4E-04	
Phenanthrene	8.2	4.8E-06	0.13	2.9E-06	3.0E-02	2.7E-02	1.6E-04	1.1E-04	2.7E-04	
Pyrene	11	6.5E-06	0.13	3.9E-06	3.0E-02	2.7E-02	2.2E-04	1.5E-04	3.6E-04	
Benzo(a)anthracene	5.1	3.0E-06	0.13	1.8E-06	3.0E-02	2.7E-02	1.0E-04	6.8E-05	1.7E-04	
Benzo(a)pyrene	6.1	3.6E-06	0.13	2.2E-06	3.0E-02	2.7E-02	1.2E-04	8.1E-05	2.0E-04	
Benzo(b)fluoranthene	6.1	3.6E-06	0.13	2.2E-06	3.0E-02	2.7E-02	1.2E-04	8.1E-05	2.0E-04	
Benzo(k)fluoranthene	5.8	3.4E-06	0.13	2.1E-06	3.0E-02	2.7E-02	1.1E-04	7.7E-05	1.9E-04	
Chrysene	6.9	4.1E-06	0.13	2.4E-06	3.0E-02	2.7E-02	1.4E-04	9.2E-05	2.3E-04	
Indeno(1,2,3-cd)pyrene	4.7	2.8E-06	0.13	1.7E-06	3.0E-02	2.7E-02	9.2E-05	6.2E-05	1.5E-04	
C9-C12 Aliphatics	2.41	1.4E-06	0.17	1.1E-06	6.0E-01	5.5E-01	2.4E-06	2.0E-06	4.4E-06	
C9-C10 Aromatics	0.386	2.3E-07	0.17	1.8E-07	3.0E-02	2.7E-02	7.6E-06	6.6E-06	1.4E-05	
C9-C18 Aliphatics	10	6.0E-06	0.17	4.7E-06	6.0E-01	5.5E-01	1.0E-05	8.6E-06	1.9E-05	
C5-C8 Aliphatics	10	5.9E-06	0.17	4.7E-06	6.0E-02	5.5E-01	9.9E-05	8.5E-06	1.1E-04	
					SUMMARY HAZARD INDEX		0.002	0.001	0.003	

TABLE 2
INHLATION OF PARTICULATES FROM SURFACE SOIL
UNRESTRICTED LAND USE - CHILD RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.31	$m^3/hour$
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * *Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration*
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

TABLE 2
INHLATION OF PARTICULATES FROM SURFACE SOIL
UNRESTRICTED LAND USE - CHILD RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Benzo(a)anthracene	5.1	NA		3.9E-09	2.3E-11	3.1E-01	7.0E-12	6.58%
Benzo(a)pyrene	6.1	NA		4.6E-09	2.7E-11	3.1E+00	8.3E-11	78.66%
Benzo(b)fluoranthene	6.1	NA		4.6E-09	2.7E-11	3.1E-01	8.3E-12	7.87%
Benzo(k)fluoranthene	5.8	NA		4.4E-09	2.6E-11	3.1E-02	7.9E-13	0.75%
Chrysene	6.9	NA		5.2E-09	3.0E-11	3.1E-03	9.4E-14	0.09%
Indeno(1,2,3-cd)pyrene	4.7	NA		3.6E-09	2.1E-11	3.1E-01	6.4E-12	6.06%
						SUMMARY CANCER RISK	1E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Acenaphthene	5.42	NA		4.1E-09	7.0E-11	8.6E-04	8.1E-08	6.96%
Benzo(g,h,I)perylene	4.4	NA		3.3E-09	5.7E-11	8.6E-04	6.6E-08	5.65%
Fluoranthene	14	NA		1.1E-08	1.8E-10	8.6E-04	2.1E-07	17.99%
Phenanthrene	8.2	NA		6.2E-09	1.1E-10	8.6E-04	1.2E-07	10.54%
Pyrene	11	NA		8.3E-09	1.4E-10	8.6E-04	1.6E-07	14.13%
Benzo(a)anthracene	5.1	NA		3.9E-09	6.6E-11	8.6E-04	7.6E-08	6.55%
Benzo(a)pyrene	6.1	NA		4.6E-09	7.8E-11	8.6E-04	9.1E-08	7.84%
Benzo(b)fluoranthene	6.1	NA		4.6E-09	7.8E-11	8.6E-04	9.1E-08	7.84%
Benzo(k)fluoranthene	5.8	NA		4.4E-09	7.5E-11	8.6E-04	8.7E-08	7.45%
Chrysene	6.9	NA		5.2E-09	8.9E-11	8.6E-04	1.0E-07	8.87%
Indeno(1,2,3-cd)pyrene	4.7	NA		3.6E-09	6.0E-11	8.6E-04	7.0E-08	6.04%
VPH								
C9-C12 Aliphatics	2.41	NA		1.8E-09	3.1E-11	5.7E-01	5.4E-11	0.00467%
C9-C10 Aromatics	0.386	NA		2.9E-10	5.0E-12	1.7E-02	2.9E-10	0.0251%
C5-C8 Aliphatics	5.77	NA		4.4E-09	7.4E-11	5.7E-02	1.3E-09	0.11%
EPH								
C9-C18 Aliphatics	2.5	NA		1.9E-09	3.2E-11	5.7E-01	5.6E-11	0.0048%
						SUMMARY HAZARD INDEX	0.000001	

TABLE 2
INHALATION OF PARTICULATES FROM SURFACE SOIL
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.63	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

TABLE 2
INHLATION OF PARTICULATES FROM SURFACE SOIL
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Benzo(a)anthracene	5.1	NA		3.9E-09	3.9E-11	3.1E-01	1.2E-11	6.58%
Benzo(a)pyrene	6.1	NA		4.6E-09	4.7E-11	3.1E+00	1.5E-10	78.66%
Benzo(b)fluoranthene	6.1	NA		4.6E-09	4.7E-11	3.1E-01	1.5E-11	7.87%
Benzo(k)fluoranthene	5.8	NA		4.4E-09	4.5E-11	3.1E-02	1.4E-12	0.75%
Chrysene	6.9	NA		5.2E-09	5.3E-11	3.1E-03	1.6E-13	0.09%
Indeno(1,2,3-cd)pyrene	4.7	NA		3.6E-09	3.6E-11	3.1E-01	1.1E-11	6.06%
						SUMMARY CANCER RISK	2E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Acenaphthene	5.42	NA		4.1E-09	1.2E-10	8.6E-04	1.4E-07	6.96%
Benzo(g,h,I)perylene	4.4	NA		3.3E-09	9.9E-11	8.6E-04	1.1E-07	5.65%
Fluoranthene	14	NA		1.1E-08	3.1E-10	8.6E-04	3.6E-07	17.99%
Phenanthrene	8.2	NA		6.2E-09	1.8E-10	8.6E-04	2.1E-07	10.54%
Pyrene	11	NA		8.3E-09	2.5E-10	8.6E-04	2.9E-07	14.13%
Benzo(a)anthracene	5.1	NA		3.9E-09	1.1E-10	8.6E-04	1.3E-07	6.55%
Benzo(a)pyrene	6.1	NA		4.6E-09	1.4E-10	8.6E-04	1.6E-07	7.84%
Benzo(b)fluoranthene	6.1	NA		4.6E-09	1.4E-10	8.6E-04	1.6E-07	7.84%
Benzo(k)fluoranthene	5.8	NA		4.4E-09	1.3E-10	8.6E-04	1.5E-07	7.45%
Chrysene	6.9	NA		5.2E-09	1.5E-10	8.6E-04	1.8E-07	8.87%
Indeno(1,2,3-cd)pyrene	4.7	NA		3.6E-09	1.1E-10	8.6E-04	1.2E-07	6.04%
VPH								
C9-C12 Aliphatics	2.41	NA		1.8E-09	5.4E-11	5.7E-01	9.5E-11	0.00467%
C9-C10 Aromatics	0.386	NA		2.9E-10	8.7E-12	1.7E-02	5.1E-10	0.0251%
C5-C8 Aliphatics	5.77	NA		4.4E-09	1.3E-10	5.7E-02	2.3E-09	0.11%
EPH								
C9-C18 Aliphatics	2.5	NA		1.9E-09	5.6E-11	5.7E-01	9.8E-11	0.0048%
						SUMMARY HAZARD INDEX	0.000002	

TABLE 3
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 1
FORT DEVENS, MA

13-Oct-99

August 1992

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²
SURFACE AREA EXPOSED	SA	2,045	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

TABLE 3
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 1
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Benzo(a)anthracene	5.1	2.4E-06	0.13	3.2E-06	7.3E-01	8.2E-01	1.7E-06	2.6E-06	4.4E-06	6.58%
Benzo(a)pyrene	6.1	2.9E-06	0.13	3.8E-06	7.3E+00	8.2E+00	2.1E-05	3.1E-05	5.2E-05	78.66%
Benzo(b)fluoranthene	6.1	2.9E-06	0.13	3.8E-06	7.3E-01	8.2E-01	2.1E-06	3.1E-06	5.2E-06	7.86%
Benzo(k)fluoranthene	5.8	2.7E-06	0.13	3.6E-06	7.3E-02	8.2E-02	2.0E-07	3.0E-07	5.0E-07	0.75%
Chrysene	6.9	3.2E-06	0.13	4.3E-06	7.3E-03	8.2E-03	2.4E-08	3.5E-08	5.9E-08	0.09%
Indeno(1,2,3-cd)pyrene	4.7	2.2E-06	0.13	2.9E-06	7.3E-01	8.2E-01	1.6E-06	2.4E-06	4.0E-06	6.06%
					SUMMARY CANCER RISK		3E-05	4E-05	7E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Acenaphthene	5.42	3.0E-05	0.13	3.9E-05	2.0E-02	1.8E-02	1.5E-03	2.2E-03	3.7E-03	10.10%
Benzo(g,h,l)perylene	4.4	2.4E-05	0.13	3.2E-05	3.0E-02	2.7E-02	8.0E-04	1.2E-03	2.0E-03	5.46%
Fluoranthene	14	7.7E-05	0.13	1.0E-04	4.0E-02	3.6E-02	1.9E-03	2.9E-03	4.8E-03	13.04%
Phenanthrene	8.2	4.5E-05	0.13	6.0E-05	3.0E-02	2.7E-02	1.5E-03	2.2E-03	3.7E-03	10.18%
Pyrene	11	6.0E-05	0.13	8.0E-05	3.0E-02	2.7E-02	2.0E-03	3.0E-03	5.0E-03	13.66%
Benzo(a)anthracene	5.1	2.8E-05	0.13	3.7E-05	3.0E-02	2.7E-02	9.3E-04	1.4E-03	2.3E-03	6.33%
Benzo(a)pyrene	6.1	3.3E-05	0.13	4.4E-05	3.0E-02	2.7E-02	1.1E-03	1.7E-03	2.8E-03	7.58%
Benzo(b)fluoranthene	6.1	3.3E-05	0.13	4.4E-05	3.0E-02	2.7E-02	1.1E-03	1.7E-03	2.8E-03	7.58%
Benzo(k)fluoranthene	5.8	3.2E-05	0.13	4.2E-05	3.0E-02	2.7E-02	1.1E-03	1.6E-03	2.6E-03	7.20%
Chrysene	6.9	3.8E-05	0.13	5.0E-05	3.0E-02	2.7E-02	1.3E-03	1.9E-03	3.1E-03	8.57%
Indeno(1,2,3-cd)pyrene	4.7	2.6E-05	0.13	3.4E-05	3.0E-02	2.7E-02	8.6E-04	1.3E-03	2.1E-03	5.84%
C9-C12 Aliphatics	2.41	1.3E-05	0.17	2.3E-05	6.0E-01	5.5E-01	2.2E-05	4.2E-05	6.4E-05	0.17%
C9-C10 Aromatics	0.386	2.1E-06	0.17	3.7E-06	3.0E-02	2.7E-02	7.1E-05	1.4E-04	2.1E-04	0.56%
C9-C18 Aliphatics	10	5.6E-05	0.17	9.7E-05	6.0E-01	5.5E-01	9.3E-05	1.8E-04	2.7E-04	0.74%
C5-C8 Aliphatics	10	5.5E-05	0.17	9.6E-05	6.0E-02	5.5E-01	9.2E-04	1.7E-04	1.1E-03	2.99%
				SUMMARY HAZARD INDEX			0.02	0.02	0.04	

N-2 CALCULATION OF EPH/VPH EXPOSURE POINT CONCENTRATIONS

Calculation of EPH and VPH Exposure Point Concentrations

Exposures to petroleum contamination in soil were evaluated using EPH and VPH data, as opposed to TPHC data. Use of EPH and VPH data permits a site-specific assessment of the petroleum-related constituents, and is consistent with the MADEP petroleum policy (MADEP, 1997). Because some soil samples collected near soil source areas during the 1995/1996 field program were analyzed for TPHC (the EPH/VPH methodology had not been promulgated at the time), it was necessary to convert the TPHC concentrations to EPH/VPH concentrations for development of exposure point concentrations (EPCs). The TPHC data were converted to EPH/VPH by calculating the average composition of EPH/VPH in site soils (based on measured EPH/VPH concentrations), and then applying the compositional information to the measured TPHC concentrations. Statistical parameters for deriving EPCs were then calculated using data sets composed of the measured and estimated EPH/VPH concentrations. This appendix provides documentation of the EPH/VPH EPC calculations.

The calculation of EPCs for EPH and VPH hydrocarbon fractions was performed in a three-step process:

1) Petroleum hydrocarbons analytical data for samples used in the risk assessment were grouped by site area (i.e., Area 2 and Area 3), exposure area (i.e., upland and wetland), and exposure medium (i.e., surface soil and subsurface soil). Tables 1 through 8 present the available TPH, EPH, and VPH data. These data summaries were used to identify samples for which only TPH data were available (i.e., samples for which no EPH or VPH analyses were performed).

2) The petroleum composition of each sample for which EPH/VPH data were available was identified by calculating the percent composition of each EPH and VPH carbon chain as a fraction of the total EPH/VPH concentration. Tables 9 and 10 show the compositional data for soils at Areas 2 and 3, respectively (shaded values in tables). One-half the sample quantitation limit was used to represent the hydrocarbon fraction concentration for results reported as not-detected. To increase the available data base of directly measured EPH/VPH data, data for surface and subsurface soil samples, as well as upland and wetland soil samples, were combined for each area. Because the same source of petroleum contamination affected soils at each of the areas, combining soil data from surface and subsurface soils and upland and wetland areas within each area should not bias the results.

3) The average percent-composition of each EPH and VPH fraction was calculated (Tables 9 and 10). The average percent composition (and range of percent composition for detected concentrations) for each EPH/VPH fraction at Areas 2 and 3 is presented below. As shown, the average percent compositions indicate that the petroleum contamination is primarily associated with heavy-end EPH fractions (e.g., C19-C36 aliphatic EPH). The narrow range of percent compositions indicates that the petroleum composition among the samples at each area is similar. Although a wide range of percent compositions is evident in the VPH fractions at Area 3, the detected EPH and VPH concentrations for the samples with elevated VPH composition was low (e.g., less than 100 mg/kg).

Area 2	Area 3
C5-C8 aliphatic VPH – Not Detected	C5-C8 aliphatic VPH – Not Detected
C9-C12 aliphatic VPH – 0.41% (0.04% - 4.3%)	C9-C12 aliphatic VPH – 3.3% (1.4% - 50%)
C9-C10 aromatic VPH – 0.29% (0.08% - 0.6%)	C9-C10 aromatic VPH – 1.3% (0.2% - 36%)
C9-C18 aliphatic EPH – 5.8% (2.5% - 11.6%)	C9-C18 aliphatic EPH – 6.4% (1.8% - 9.7%)
C19-C36 aliphatic EPH – 71% (57% - 79%)	C19-C36 aliphatic EPH – 76% (64% - 89%)
C11-C22 aromatic EPH – 22% (17% - 38%)	C11-C22 aromatic EPH – 12% (9.5% - 13%)

4) The petroleum compositional information calculated in Step 2 was used to calculate EPH and VPH equivalent concentrations in samples for which only TPH data was available. EPH/VPH equivalent concentrations were calculated by multiplying the measured TPH concentrations (in samples for which only TPH data were available) by the average percent-composition of petroleum at the appropriate area. These calculations, as well as the EPH and VPH concentrations estimated from the compositional information, are shown in Tables 9 and 10.

5) Exposure point concentrations were calculated for each exposure point using the measured EPH/VPH concentrations (when available) and calculated EPH/VPH concentrations (samples for which TPH data was converted to EPH/VPH concentrations). Exposure point concentrations for use in the risk assessment were the lesser of the 95% upper confidence limit (for data sets with 10 or more samples) and the maximum detected concentration. EPC calculations are shown in Tables 11 through 17.

TABLE 1
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SURFACE SOIL
AREA 2 INDUSTRIAL
AOC 57 RF

SAMPLE ID	BX570100	BX570200	EX570200	EX571000	EX572500		MIN	MAX	
SAMPLE LOCATION	57B-95-01X	57B-95-02X	57E-95-02X	57E-95-10X	57E-95-25X	FOD	DETECT	DETECT	AVERAGE[1]
ANALYTES									
TPH (mg/Kg)	81	7970	454	25	81	5/5	25	7970	1722
VPH RANGES (mg/Kg)									
C5 - C8 Aliphatics	NA	NA	NA	NA	NA	N/A	N/A	N/A	N/A
C9 - C12 Aliphatics	NA	NA	NA	NA	NA	N/A	N/A	N/A	N/A
C9 - C10 Aromatics	NA	NA	NA	NA	NA	N/A	N/A	N/A	N/A
EPH RANGES (mg/Kg)									
C9 - C18 Aliphatics	NA	NA	NA	NA	NA	N/A	N/A	N/A	N/A
C19 -C36 Aliphatics	NA	NA	NA	NA	NA	N/A	N/A	N/A	N/A
C11 - C22 Aromatics	NA	NA	NA	NA	NA	N/A	N/A	N/A	N/A

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
FOD = Frequency of detection
mg/Kg = milligrams per kilograms
N/A = Not applicable
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 2
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 2 INDUSTRIAL
AOC 57 RF

SAMPLE ID	BX570105	EX570106	BX570205	EX570405		MIN	MAX	
SAMPLE LOCATION	57B-95-01X	57E-95-01X	57B-95-02X	57E-95-04X(+ dup)	FOD	DETECT	DETECT	AVERAGE[1]
ANALYTES								
TPH (mg/Kg)	26	141	87	19	4/4	19	141	68
VPH RANGES (mg/Kg)								
C5 - C8 Aliphatics	NA	NA	NA	NA	N/A	N/A	N/A	N/A
C9 - C12 Aliphatics	NA	NA	NA	NA	N/A	N/A	N/A	N/A
C9 - C10 Aromatics	NA	NA	NA	NA	N/A	N/A	N/A	N/A
EPH RANGES (mg/Kg)								
C9 - C18 Aliphatics	NA	NA	NA	NA	N/A	N/A	N/A	N/A
C19 -C36 Aliphatics	NA	NA	NA	NA	N/A	N/A	N/A	N/A
C11 - C22 Aromatics	NA	NA	NA	NA	N/A	N/A	N/A	N/A

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
mg/Kg = milligrams per kilograms
N/A = Not applicable
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 3
SUMMARY OF PETROLEUM HYDROCARBONS RESULT IN SURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RF

SAMPLE ID	EX571200	EX571600	EX571700	SF570101	SF570200	SF570401	SF570601	SF570700	SF570701	SF570800	SF570900
SAMPLE LOCATION	57E-95-12X	57E-95-16X	57E-95-17X	57S-98-01F	57S-98-02F	57S-98-04F	57S-98-06X	57S-98-07X(+ dup)	57S-98-07X	57S-98-08X	57S-98-09X
ANALYTES											
TPH (mg/Kg)	5110	169	2390	393	1200	1150	4620	4000	17000	494	1930
VPH RANGES (mg/Kg)											
C5 - C8 Aliphatics	NA	NA	NA	<1.3	<2.5	<1.3	<2.3	<9.0	<3.5	<5.3	<3.6
C9 - C12 Aliphatics	NA	NA	NA	4.3	2.5	<1.3	3.9	9.82	15	6.4	6.4
C9 - C10 Aromatics	NA	NA	NA	<1.3	<2.5	<1.3	<2.3	16.5	<3.5	13	<3.6
EPH RANGES (mg/Kg)											
C9 - C18 Aliphatics	NA	NA	NA	<44	<55	<37	120	<165	270	<100	<83
C19 -C36 Aliphatics	NA	NA	NA	68	360	260	830	1950	1600	<100	240
C11 - C22 Aromatics	NA	NA	NA	<44	240	140	190	550	450	<100	110

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
N/A = Not applicable
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 3

SUMMARY OF PETROLEUM HYDROCARBONS RESULT IN SURFACE SOIL

AREA 2 RECREATIONAL

AOC 57 RF

SAMPLE ID		MIN	MAX	
SAMPLE LOCATION	FOD	DETECT	DETECT	AVERAGE[1]
ANALYTES				
TPH (mg/Kg)	11/11	169	17,000	3496
VPH RANGES (mg/Kg)				
C5 - C8 Aliphatics	0/8	N/A	N/A	1.8
C9 - C12 Aliphatics	7/8	2.5	15	6.1
C9 - C10 Aromatics	2/8	13	16.5	4.6
EPH RANGES (mg/Kg)				
C9 - C18 Aliphatics	2/8	120	270	79
C19 -C36 Aliphatics	7/8	68	1950	670
C11 - C22 Aromatics	6/8	110	550	247

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocar
VPH = Volatile Petroleum Hydro
EPH = Extractable Petroleum Hy
mg/Kg = milligrams per kilogram
FOD = Frequency of detection
N/A = Not applicable
[1] The average represents the ari

TABLE 4
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RF

SAMPLE ID	EX570704	EX570804	EX570905	EX571305	EX571406	EX571502	EX571602	EX571802	EX571902	EX572005	SF570302	SF570503
SAMPLE LOCATION	57E-95-07X	57E-95-08X	57E-95-09X	57E-95-13X	57E-95-14X	57E-95-15X	57E-95-16X	57E-95-18X	57E-95-19X	57E-95-20X	57S-98-03F	57S-98-05F
ANALYTES												
TPH (mg/Kg)	31,800	58	79	<28	49	26,100	30,000	50	130	63	14,800	1750
VPH RANGES (mg/Kg)												
C5 - C8 Aliphatics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.6	<1.0
C9 - C12 Aliphatics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.9	2.1
C9 - C10 Aromatics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1.6	<1.0
EPH RANGES (mg/Kg)												
C9 - C18 Aliphatics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	110	<33
C19 -C36 Aliphatics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3300	610
C11 - C22 Aromatics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	990	140

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 4
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RF

SAMPLE ID		MIN	MAX	
SAMPLE LOCATION	FOD	DETECT	DETECT	AVERAGE[1]
ANALYTES				
TPH (mg/Kg)	11/12	49	31,800	8741
VPH RANGES (mg/Kg)				
C5 - C8 Aliphatics	0/2	N/A	N/A	1.3
C9 - C12 Aliphatics	2/2	1.9	2.1	2
C9 - C10 Aromatics	0/2	N/A	N/A	1.3
EPH RANGES (mg/Kg)				
C9 - C18 Aliphatics	1/2	110	110	63.2
C19 -C36 Aliphatics	2/2	610	3300	1955
C11 - C22 Aromatics	2/2	140	990	565

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocar
VPH = Volatile Petroleum Hydro
EPH = Extractable Petroleum Hy
N/A = Not applicable
mg/Kg = milligrams per kilogram
FOD = Frequency of detection
[1] The average represents the ari

TABLE 5
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RF

SAMPLE ID	BX570800	BX570900	EX57W05X	EX57W10X	EX57W02X	EX57W17X		MIN	MAX	
SAMPLE LOCATION	57B-95-08X	57B-95-09X					FOD	DETECT	DETECT	AVERAGE[1]
ANALYTES										
TPH (mg/Kg)	50	39	NA	NA	NA	NA	2/2	39	50	44.5
VPH RANGES (mg/Kg)										
C5 - C8 Aliphatics	NA	NA	<19	<15.5	<21.5	<16	0/4	N/A	N/A	N/A
C9 - C12 Aliphatics	NA	NA	<4.7	<3.85	<5.35	16	1/4	16	16	5.74
C9 - C10 Aromatics	NA	NA	<4.7	<3.85	4.85	<4	1/4	4.85	4.85	2.78
EPH RANGES (mg/Kg)										
C9 - C18 Aliphatics	NA	NA	<6.4	<6.95	<7.25	<3.6	0/4	N/A	N/A	N/A
C19 -C36 Aliphatics	NA	NA	<6.4	<6.95	7.28	<4.8	1/4	7.28	7.28	4.09
C11 - C22 Aromatics	NA	NA	<17	<18.5	<19.5	<19	0/4	N/A	N/A	N/A

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of Detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 6
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RF

SAMPLE ID	BX570805	BX570905	BX571110	EX57W06X	EX57W07X	EX57W08X	EX57W09X	EX57F01X	EX57F02X
SAMPLE LOCATION	57B-96-08X	57B-96-09X	57B-96-11X (+dup)						
ANALYTES									
TPH (mg/Kg)	<28	<28	25	NA	NA	NA	NA	NA	NA
VPH RANGES (mg/Kg)									
C5 - C8 Aliphatics	NA	NA	NA	<18	<18	<18	<15	<18	<18
C9 - C12 Aliphatics	NA	NA	NA	<4.6	<4.5	<4.5	<3.7	<4.6	<4.6
C9 - C10 Aromatics	NA	NA	NA	<4.6	<4.5	<4.5	<3.7	<4.6	<4.6
EPH RANGES (mg/Kg)									
C9 - C18 Aliphatics	NA	NA	NA	<6.4	9	<6.3	<6.3	78	<7.6
C19 -C36 Aliphatics	NA	NA	NA	20	440	10	<6.3	990	12
C11 - C22 Aromatics	NA	NA	NA	<17	37	<17	<17	110	<20

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 6
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RF

SAMPLE ID		MIN	MAX	
SAMPLE LOCATION	FOD	DETECT	DETECT	AVERAGE[1]
ANALYTES				
TPH (mg/Kg)	1/3	25	25	17.7
VPH RANGES (mg/Kg)				
C5 - C8 Aliphatics	0/6	N/A	N/A	N/A
C9 - C12 Aliphatics	0/6	N/A	N/A	N/A
C9 - C10 Aromatics	0/6	N/A	N/A	N/A
EPH RANGES (mg/Kg)				
C9 - C18 Aliphatics	2/6	9	78	16.7
C19 -C36 Aliphatics	5/6	10	990	246
C11 - C22 Aromatics	2/6	37	110	30.4

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbo
VPH = Volatile Petroleum Hydrocar
EPH = Extractable Petroleum Hydr
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
[1] The average represents the arith

TABLE 7
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SURFACE SOIL
AREA 3 RECREATIONAL
AOC 57 RF

SAMPLE ID	SF571301	SF571401	EX5703X	EX57W14X	EX57W15X	EX57W16X		MIN	MAX	
SAMPLE LOCATION	57S-98-13F	57S-98-14F					FOD	DETECT	DETECT	AVERAGE[1]
ANALYTES										
TPH (mg/Kg)	951	895	NA	NA	NA	NA	2/2	895	951	923
VPH RANGES (mg/Kg)										
C5 - C8 Aliphatics	<1.8	<1.4	<15	<17	<23	<150	0/6	N/A	N/A	N/A
C9 - C12 Aliphatics	3.7	<1.4	47	110	<5.7	1500	4/6	3.7	1500	277
C9 - C10 Aromatics	<1.8	<1.4	37	55	<5.7	600	3/6	37	600	116
EPH RANGES (mg/Kg)										
C9 - C18 Aliphatics	<46	<40	<7.5	920	765	1300	3/6	765	1300	505
C19 -C36 Aliphatics	180	150	<7.5	20,000	7200	8600	5/6	150	20,000	6022
C11 - C22 Aromatics	60	75	<20	3100	1200	1400	5/6	60	3100	974

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilogram
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 8
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 3 RECREATIONAL
AOC 57 RF

SAMPLE ID	SX571503		MIN	MAX	
SAMPLE LOCATION	57S-98-15X	FOD	DETECT	DETECT	AVERAGE[1]
ANALYTES					
TPH (mg/Kg)	<27.9	0/1	N/A	N/A	N/A
<u>VPH RANGES (mg/Kg)</u>					
C5 - C8 Aliphatics	<1.3	0/1	N/A	N/A	N/A
C9 - C12 Aliphatics	<1.3	0/1	N/A	N/A	N/A
C9 - C10 Aromatics	<1.3	0/1	N/A	N/A	N/A
<u>EPH RANGES (mg/Kg)</u>					
C9 - C18 Aliphatics	<37	0/1	N/A	N/A	N/A
C19 -C36 Aliphatics	<37	0/1	N/A	N/A	N/A
C11 - C22 Aromatics	<37	0/1	N/A	N/A	N/A

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
mg/Kg = milligrams per kilograms
N/A = Not applicable
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID	SF570101				SF570200				SF570302			
OFF-SITE SAMPLE ID	SX570101				SX570200				SX570302			
DATE COLLECTED	19-May-98				19-May-98				19-May-98			
DATE ANALYZED	19-May-98		ADJ	%	19-May-98		ADJ	%	19-May-98		ADJ	%
Off-Site TPH (mg/Kg-dry)	393				1200				14800			
VPH Ranges (mg/Kg)												
n-C5 to n-C8 Aliphatic*	<1.3				< 2.5	J			< 1.6	J		
n-C9 to n-C12 Aliphatic*	4.3		4.3	3.7%	2.5	J	2.5	0.4%	1.9	J	1.9	0.043%
n-C9 to n-C10 Aromatic	<1.3		0.65	0.6%	< 2.5	J	1.25	0.2%	< 1.6	J	0.8	0.018%
EPH Ranges (mg/Kg)												
n-C9 to n-C18 Aliphatic	<44	J	22	18.8%	<55	J	27.5	4.4%	110	J	110	2.5%
n-C19 to n-C36 Aliphatic	68		68	58.1%	360		360	57.0%	3300		3300	75.0%
n-C11 to n-C22 Aromatic**	<44		22	18.8%	240		240	38.0%	990		990	22.5%
TOTAL EPH/VPH			116.95				631.25	100%			4402.7	100%

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TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID	SF570401				SF570503			SF570601				SF570700(+dup)				SF570701
OFF-SITE SAMPLE ID	SX570401				SX570503			SX570601				SX570700(+dup)				SX570701
DATE COLLECTED	19-May-98				19-May-98			19-May-98				19-May-98				19-May-98
DATE ANALYZED	19-May-98		ADJ	%	19-May-98	ADJ	%	19-May-98		ADJ	%	19-May-98		ADJ	%	20-May-98
Off-Site TPH (mg/Kg-dry)	1150				1750			4620				4000	D			17000
VPH Ranges (mg/Kg)																
n-C5 to n-C8 Aliphatic*	< 1.3				< 1.0			<2.3	J			<9.0	J			< 3.5
n-C9 to n-C12 Aliphatic*	< 1.3		0.65	0.155%	2.1	2.1	0.273%	3.9	J	3.9	0.341%	9.825	J	9.825	0.377%	15
n-C9 to n-C10 Aromatic	< 1.3		0.65	0.155%	< 1.0	0.5	0.065%	<2.3	J	1.15	0.100%	16.5	J	16.5	0.632%	< 3.5
EPH Ranges (mg/Kg)																
n-C9 to n-C18 Aliphatic	<37	J	18.5	4.4%	<33	16.5	2.1%	120	J	120	10.5%	<165	J	82.5	3.2%	270
n-C19 to n-C36 Aliphatic	260		260	61.9%	610	610	79.3%	830		830	72.5%	1950		1950	74.7%	1600
n-C11 to n-C22 Aromatic**	140		140	33.3%	140	140	18.2%	190		190	16.6%	550		550	21.1%	450
TOTAL EPH/VPH			419.8	100%		769.1	100%			1145.05	100%			2608.83	100%	

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TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID				SF570800				SF570900			
OFF-SITE SAMPLE ID				SX570800				SX570900			
DATE COLLECTED				19-May-98				19-May-98			
DATE ANALYZED		ADJ	%	20-May-98		ADJ	%	20-May-98		ADJ	%
Off-Site TPH (mg/Kg-dry)				494				1930			
VPH Ranges (mg/Kg)											
n-C5 to n-C8 Aliphatic*	J			<5.3	J			<3.6	J		
n-C9 to n-C12 Aliphatic*	J	15	0.642%	6.4	J	6.4	3.778%	6.4	J	6.4	1.601%
n-C9 to n-C10 Aromatic	J	1.75	0.075%	13	J	13	7.674%	<3.6	J	1.8	0.450%
EPH Ranges (mg/Kg)											
n-C9 to n-C18 Aliphatic	J	270	11.6%	<100	J	50	29.5%	<83	J	41.5	10.4%
n-C19 to n-C36 Aliphatic		1600	68.5%	<100		50	29.5%	240		240	60.0%
n-C11 to n-C22 Aromatic**		450	19.3%	<100		50	29.5%	110		110	27.5%
TOTAL EPH/VPH		2336.75	100%			169.4				399.7	100%

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TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID OFF-SITE SAMPLE ID DATE COLLECTED DATE ANALYZED	AVE ADJ	AVE %	57B-95-01X BX570100 9/26/95	VPH/EPH USING CORRELATION	57B-95-02X BX570200 9/27/95	VPH/EPH USING CORRELATION	57E-95-02X EX570200 9/18/96
Off-Site TPH (mg/Kg-dry)			81		7970		454
VPH Ranges (mg/Kg)							
n-C5 to n-C8 Aliphatic*				0		0	
n-C9 to n-C12 Aliphatic*	5.3	**0.41%**		0.33		32	
n-C9 to n-C10 Aromatic	3.8	**0.29%**		0.24		23	
EPH Ranges (mg/Kg)							
n-C9 to n-C18 Aliphatic	75.9	**5.83%**		4.7		465	
n-C19 to n-C36 Aliphatic	926.8	**71.29%**		58		5682	
n-C11 to n-C22 Aromatic**	288.2	**22.17%**		18		1767	
TOTAL EPH/VPH	1300	**100%**		81		7970	

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID OFF-SITE SAMPLE ID DATE COLLECTED DATE ANALYZED	VPH/EPH USING CORRELATION	57E-95-10X EX571000 9/19/95	VPH/EPH USING CORRELATION	57E-95-25X EX572500 9/22/95	VPH/EPH USING CORRELATION	57E-95-12X EX571200 9/20/95	VPH/EPH USING CORRELATION	57E-95-16X EX571600 9/21/95
Off-Site TPH (mg/Kg-dry)		25		81		5110		169
VPH Ranges (mg/Kg)								
n-C5 to n-C8 Aliphatic*	0		0		0		0	
n-C9 to n-C12 Aliphatic*	1.9		0.102		0.33		21	
n-C9 to n-C10 Aromatic	1.3		0.073		0.24		15	
EPH Ranges (mg/Kg)								
n-C9 to n-C18 Aliphatic	26		1.5		4.7		298	
n-C19 to n-C36 Aliphatic	324		18		58		3643	
n-C11 to n-C22 Aromatic**	101		6		18		1133	
TOTAL EPH/VPH	454		25		81		5110	

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TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID OFF-SITE SAMPLE ID DATE COLLECTED DATE ANALYZED	VPH/EPH USING CORRELATION	57E-95-17X EX571700 9/21/95	VPH/EPH USING CORRELATION	57B-95-01X BX570105 9/26/95	VPH/EPH USING CORRELATION	57B-95-02X BX570205 9/27/95	VPH/EPH USING CORRELATION
Off-Site TPH (mg/Kg-dry)		2390		26		87	
VPH Ranges (mg/Kg)							
n-C5 to n-C8 Aliphatic*	0		0		0		0
n-C9 to n-C12 Aliphatic*	0.69		10		0.108		0.35
n-C9 to n-C10 Aromatic	0.49		7.0		0.077		0.25
EPH Ranges (mg/Kg)							
n-C9 to n-C18 Aliphatic	9.9		139		1.5		5.1
n-C19 to n-C36 Aliphatic	120		1704		19		62
n-C11 to n-C22 Aromatic**	37		530		5.9		19
TOTAL EPH/VPH	169		2390		26		87

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID OFF-SITE SAMPLE ID DATE COLLECTED DATE ANALYZED	57B-95-04X BX570405 9/19/95	VPH/EPH USING CORRELATION	57E-95-01X EX570106 9/18/95	VPH/EPH USING CORRELATION	57E-95-07X EX570704 9/19/95	VPH/EPH USING CORRELATION	57E-95-08X EX570804 9/20/95	VPH/EPH USING CORRELATION
Off-Site TPH (mg/Kg-dry)	19		141		31,800		58	
VPH Ranges (mg/Kg)								
n-C5 to n-C8 Aliphatic*		0		0		0		0
n-C9 to n-C12 Aliphatic*		0.076		0.57		130		0.23
n-C9 to n-C10 Aromatic		0.055		0.41		93		0.17
EPH Ranges (mg/Kg)								
n-C9 to n-C18 Aliphatic		1.1		8.2		1855		3.4
n-C19 to n-C36 Aliphatic		13		101		22672		41
n-C11 to n-C22 Aromatic**		4		31		7050		13
TOTAL EPH/VPH		19		141		31800		58

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID OFF-SITE SAMPLE ID DATE COLLECTED DATE ANALYZED	57E-95-09X EX570905 9/20/95	VPH/EPH USING CORRELATION	57E-95-13X EX571305 9/21/95	57E-95-13X 1/2 DETECT	VPH/EPH USING CORRELATION	57E-95-14X EX571406 9/21/95	VPH/EPH USING CORRELATION	57E-95-15X EX571502 9/21/95
Off-Site TPH (mg/Kg-dry)	79		<28	14		49		26100
VPH Ranges (mg/Kg)								
n-C5 to n-C8 Aliphatic*		0			0			
n-C9 to n-C12 Aliphatic*		0.32			0.06		0.20	
n-C9 to n-C10 Aromatic		0.23			0.04		0.14	
EPH Ranges (mg/Kg)								
n-C9 to n-C18 Aliphatic		4.6			0.82		2.9	
n-C19 to n-C36 Aliphatic		56			9.98		35	
n-C11 to n-C22 Aromatic**		18			3.10		11	
TOTAL EPH/VPH		79			14		49	

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID	
OFF-SITE SAMPLE ID	VPH/EPH USING CORRELATION
DATE COLLECTED	
DATE ANALYZED	
Off-Site TPH (mg/Kg-dry)	
VPH Ranges (mg/Kg)	
n-C5 to n-C8 Aliphatic*	
n-C9 to n-C12 Aliphatic*	106
n-C9 to n-C10 Aromatic	76
EPH Ranges (mg/Kg)	
n-C9 to n-C18 Aliphatic	1523
n-C19 to n-C36 Aliphatic	18608
n-C11 to n-C22 Aromatic**	5786
TOTAL EPH/VPH	26100

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

ON-SITE SAMPLE ID OFF-SITE SAMPLE ID DATE COLLECTED DATE ANALYZED	57E-95-16X EX571602 9/21/95	VPH/EPH USING CORRELATION	57E-95-18X EX571802 9/21/95	VPH/EPH USING CORRELATION	57E-95-19X EX571902 9/21/95	VPH/EPH USING CORRELATION	57E-95-20X EX572005 9/21/95	VPH/EPH USING CORRELATION
Off-Site TPH (mg/Kg-dry)	30000		50		130		63	
<u>VPH Ranges (mg/Kg)</u>								
n-C5 to n-C8 Aliphatic*								
n-C9 to n-C12 Aliphatic*		122		0.20		0.53		0.25
n-C9 to n-C10 Aromatic		88		0.14		0.38		0.18
<u>EPH Ranges (mg/Kg)</u>								
n-C9 to n-C18 Aliphatic		1750		2.9		7.6		3.6
n-C19 to n-C36 Aliphatic		21388		35		93		45
n-C11 to n-C22 Aromatic**		6651		11		29		14
TOTAL EPH/VPH		30000		50		130		63

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

OFF-SITE SAMPLE ID		SX571301				SX571401			
DATE COLLECTED	S-1	20-May-98				20-May-98			
DATE ANALYZED	(ug/g)	20-May-98		ADJ	%	20-May-98		ADJ	%
Off-Site TPH (mg/Kg-dry)	200	951				895			
<u>VPH Ranges (mg/Kg)</u>									
n-C5 to n-C8 Aliphatic*	100	<1.8	J			<1.4			
n-C9 to n-C12 Aliphatic*	1000	3.7	J	3.7	1.38%	<1.4		0.7	0.28%
n-C9 to n-C10 Aromatic	100	<1.8	J	0.9	0.34%	<1.4		0.7	0.28%
<u>EPH Ranges (mg/Kg)</u>									
n-C9 to n-C18 Aliphatic	1000	<46	J	23	8.59%	<40	J	20	8.12%
n-C19 to n-C36 Aliphatic	2500	180		180	67.26%	150		150	60.88%
n-C11 to n-C22 Aromatic**	200	60		60	22.42%	75	J	75	30.44%
TOTAL EPH/VPH				267.6	100%			246.4	100%

Notes:
* concentrations of target compounds including n-pentane, 2-methylpentane, MTBE, 2,2,4-trimethylpentane, n-noname, BTEX, 1,2,4-trimethyl and naphthalene have been subtacted when determining concentration.
** concentrations of PAH target compounds have been subtracted when determining concentration.

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

OFF-SITE SAMPLE ID	SX571503			EX57W05X			EX57W10X		
DATE COLLECTED	20-May-98			25-Mar-99			16-Apr-99		
DATE ANALYZED	20-May-98	ADJ	%		ADJ	%		ADJ	%
Off-Site TPH (mg/Kg-dry)	<27.9			NA			NA		
VPH Ranges (mg/Kg)									
n-C5 to n-C8 Aliphatic*	<1.3			<19			<15.5		
n-C9 to n-C12 Aliphatic*	<1.3	0.65	1.14%	<4.7	2.35	11.99%	<3.85	1.92	13.45%
n-C9 to n-C10 Aromatic	<1.3	0.65	1.14%	<4.7	2.35	11.99%	<3.85	1.92	13.45%
EPH Ranges (mg/Kg)									
n-C9 to n-C18 Aliphatic	<37 J	18.5	32.57%	<6.4	3.2	16.33%	<6.95	3.48	24.37%
n-C19 to n-C36 Aliphatic	<37	18.5	32.57%	<6.4	3.2	16.33%	<6.95	3.48	24.37%
n-C11 to n-C22 Aromatic**	<37	18.5	32.57%	<17	8.5	43.37%	<18.5	3.48	24.37%
TOTAL EPH/VPH		56.8	100%		19.6	100%		14.28	100%

Notes:
* concentrations of target compounds includi enzene,
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

OFF-SITE SAMPLE ID	EX57W02X			EX57W17X			EX57W14X		
DATE COLLECTED	25-Mar-99								
DATE ANALYZED		ADJ	%		ADJ	%		ADJ	%
Off-Site TPH (mg/Kg-dry)									
VPH Ranges (mg/Kg)									
n-C5 to n-C8 Aliphatic*	<21.5			<16			<17		
n-C9 to n-C12 Aliphatic*	<5.35	2.68	9.51%	16	16	50.47%	110	110	0.45%
n-C9 to n-C10 Aromatic	4.85	4.85	17.20%	<4.0	2	6.31%	55	55	0.23%
EPH Ranges (mg/Kg)									
n-C9 to n-C18 Aliphatic	<7.25	3.63	12.88%	<3.6	1.8	5.68%	920	920	3.80%
n-C19 to n-C36 Aliphatic	7.28	7.28	25.82%	<4.8	2.4	7.57%	20,000	20,000	82.70%
n-C11 to n-C22 Aromatic**	<19.5	9.75	34.59%	<19	9.5	29.97%	3100	3100	12.82%
TOTAL EPH/VPH		28.19	100%		31.7	100%		24185	100%

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

OFF-SITE SAMPLE ID	EX57W15X			EX57W16X			EX57W06X		
DATE COLLECTED							25-Mar-99		
DATE ANALYZED		ADJ	%		ADJ	%		ADJ	%
Off-Site TPH (mg/Kg-dry)									
VPH Ranges (mg/Kg)									
n-C5 to n-C8 Aliphatic*	<23			<150			<18		
n-C9 to n-C12 Aliphatic*	<5.7	2.85	0.03%	1500	1500	11.19%	<4.6	2.3	6.34%
n-C9 to n-C10 Aromatic	<5.7	2.85	0.03%	600	600	4.48%	<4.6	2.3	6.34%
EPH Ranges (mg/Kg)									
n-C9 to n-C18 Aliphatic	765	765	8.34%	1300	1300	9.70%	<6.4	3.2	8.82%
n-C19 to n-C36 Aliphatic	7200	7200	78.51%	8600	8600	64.18%	20	20	55.10%
n-C11 to n-C22 Aromatic**	1200	1200	13.09%	1400	1400	10.45%	<17	8.5	23.42%
TOTAL EPH/VPH		9170.7	100%		13400	100%		36.3	100%

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

OFF-SITE SAMPLE ID	EX57W07X			EX57W08X			EX57W09X		
DATE COLLECTED	25-Mar-99			25-Mar-99			16-Apr-99		
DATE ANALYZED		ADJ	%		ADJ	%		ADJ	%
Off-Site TPH (mg/Kg-dry)									
VPH Ranges (mg/Kg)									
n-C5 to n-C8 Aliphatic*	<18			<18			<15		
n-C9 to n-C12 Aliphatic*	<4.5	2.25	0.46%	<4.5	2.25	8.60%	<3.7	1.85	10.00%
n-C9 to n-C10 Aromatic	<4.5	2.25	0.46%	<4.5	2.25	8.60%	<3.7	1.85	10.00%
EPH Ranges (mg/Kg)									
n-C9 to n-C18 Aliphatic	9	9	1.83%	<6.3	3.15	12.05%	<6.3	3.15	17.03%
n-C19 to n-C36 Aliphatic	440	440	89.70%	10	10	38.24%	<6.3	3.15	17.03%
n-C11 to n-C22 Aromatic**	37	37	7.54%	<17	8.5	32.50%	<17	8.5	45.95%
TOTAL EPH/VPH		490.5	100%		26.15	100%		18.5	100%

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

OFF-SITE SAMPLE ID	EX57F01X			EX57F02X			EX57F03X		
DATE COLLECTED	25-Mar-99			25-Mar-99			15-Apr-99		
DATE ANALYZED		ADJ	%		ADJ	%		ADJ	%
Off-Site TPH (mg/Kg-dry)									
VPH Ranges (mg/Kg)									
n-C5 to n-C8 Aliphatic*	<18			<18			<15		
n-C9 to n-C12 Aliphatic*	<4.6	2.3	0.19%	<4.6	2.3	7.57%	47	47	46.31%
n-C9 to n-C10 Aromatic	<4.6	2.3	0.19%	<4.6	2.3	7.57%	37	37	36.45%
EPH Ranges (mg/Kg)									
n-C9 to n-C18 Aliphatic	78	78	6.60%	<7.6	3.8	12.50%	<7.5	3.75	3.69%
n-C19 to n-C36 Aliphatic	990	990	83.71%	12	12	39.47%	<7.5	3.75	3.69%
n-C11 to n-C22 Aromatic**	110	110	9.30%	<20	10	32.89%	<20	10	9.85%
TOTAL EPH/VPH	1178	1182.6	100%	12	30.4	100%		102	100%

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

OFF-SITE SAMPLE ID DATE COLLECTED DATE ANALYZED	ADJ AVE	AVE %	BX570800 8/28/96	VPH/EPH USING CORRELATION	BX570900 8/29/96	VPH/EPH USING CORRELATION
Off-Site TPH (mg/Kg-dry)			50		39	
VPH Ranges (mg/Kg)						
n-C5 to n-C8 Aliphatic*						
n-C9 to n-C12 Aliphatic*	**103**	**3.36%**		1.7		1.3
n-C9 to n-C10 Aromatic	**43**	**1.39%**		0.70		0.55
EPH Ranges (mg/Kg)						
n-C9 to n-C18 Aliphatic	**197**	**6.42%**		3.2		2.5
n-C19 to n-C36 Aliphatic	**2353**	**76.50%**		38		30
n-C11 to n-C22 Aromatic**	**379**	**12.33%**		6.2		4.9
TOTAL EPH/VPH	**3075**	**100%**		50		39

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

OFF-SITE SAMPLE ID **DATE COLLECTED** **DATE ANALYZED**	BX570805 8/29/96	BX570805 1/2 DETECT	VPH/EPH USING CORRELATION	BX570905 8/29/96	BX570905 1/2 DETECT	VPH/EPH USING CORRELATION
Off-Site TPH (mg/Kg-dry)	<28	14		<28	14	
<u>VPH Ranges (mg/Kg)</u>						
n-C5 to n-C8 Aliphatic*						
n-C9 to n-C12 Aliphatic*			0.47			0.47
n-C9 to n-C10 Aromatic			0.19			0.19
<u>EPH Ranges (mg/Kg)</u>						
n-C9 to n-C18 Aliphatic			0.90			0.90
n-C19 to n-C36 Aliphatic			11			11
n-C11 to n-C22 Aromatic**			1.7			1.7
TOTAL EPH/VPH			14			14

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10

CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA

AREA 3

AOC 57 RI

OFF-SITE SAMPLE ID **DATE COLLECTED** **DATE ANALYZED**	EX570106 9/18/95	VPH/EPH USING CORRELATION	BX571110 9/3/96	VPH/EPH USING CORRELATION
Off-Site TPH (mg/Kg-dry)	141		25	
<u>VPH Ranges (mg/Kg)</u>				
n-C5 to n-C8 Aliphatic*				
n-C9 to n-C12 Aliphatic*		4.7		0.84
n-C9 to n-C10 Aromatic		2.0		0.35
<u>EPH Ranges (mg/Kg)</u>				
n-C9 to n-C18 Aliphatic		9.1		1.6
n-C19 to n-C36 Aliphatic		108		19
n-C11 to n-C22 Aromatic**		17		3.1
TOTAL EPH/VPH		141		25

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 11

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 2 INDUSTRIAL
AOC 57 RI

SAMPLE ID	BX570100	BX570200	EX570200	EX571000	EX572500		MAX	95%	
SAMPLE LOCATION	57B-95-01X	57B-95-02X	57E-95-02X	57E-95-10X	57E-95-25X	AVERAGE[1]	DETECT	UCL	EPC[2]
ANALYTES									
TPH (mg/Kg)[3]	81	7970	454	25	81	N/A	N/A	N/A	N/A
VPH RANGES (mg/Kg)*									
C5 - C8 Aliphatics	ND	ND	ND	ND	ND	N/A	N/A	N/A	N/A
C9 - C12 Aliphatics	0.33	32	1.9	0.1	0.33	6.9	32	NC	32
C9 - C10 Aromatics	0.24	23	1.3	0.073	0.24	5.0	23	NC	23
EPH RANGES (mg/Kg)*									
C9 - C18 Aliphatics	4.7	465	26	1.5	4.7	100	465	NC	465
C19 -C36 Aliphatics	58	5682	324	18	58	1228	5682	NC	5682
C11 - C22 Aromatics	18	1767	101	6	18	382	1767	NC	1767

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

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TABLE 12

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SUBSURFACE SOIL
AREA 2 INDUSTRIAL
AOC 57 RI

SAMPLE ID	BX570105	EX570106	BX570205	EX570405		MAX	95%	
SAMPLE LOCATION	57B-95-01X	57E-95-01X	57B-95-02X	57E-95-04X(+ dup)	AVERAGE[1]	DETECT	UCL	EPC[2]
ANALYTES								
TPH (mg/Kg)[3]	26	141	87	19	N/A	N/A	N/A	N/A
VPH RANGES (mg/Kg)*								
C5 - C8 Aliphatics	ND	ND	ND	ND	N/A	N/A	N/A	N/A
C9 - C12 Aliphatics	0.11	0.57	0.35	0.076	0.28	0.57	NC	0.57
C9 - C10 Aromatics	0.077	0.41	0.25	0.055	0.20	0.41	NC	0.41
EPH RANGES (mg/Kg)*								
C9 - C18 Aliphatics	1.5	8.2	5.1	1.1	4.0	8.2	NC	8.2
C19 -C36 Aliphatics	19	101	62	13	49	101	NC	101
C11 - C22 Aromatics	5.9	31	19	4	15	31	NC	31

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is *not calculated because petroleum hydrocarbon fractions are evaluated* instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

TABLE 13
EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RI

SAMPLE ID	EX571200	EX571600	EX571700	SF570101	SF570200	SF570401	SF570601	SF570700	SF570701	SF570800	SF570900
SAMPLE LOCATION	57E-95-12X	57E-95-16X	57E-95-17X	57S-98-01F	57S-98-02F	57S-98-04F	57S-98-06X	57S-98-07X(+ dup)	57S-98-07X	57S-98-08X	57S-98-09X
ANALYTES											
TPH (mg/Kg)[3]	5110	169	2390	393	1200	1150	4620	4000	17000	494	1930
VPH RANGES (mg/Kg)*											
C5 - C8 Aliphatics	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C9 - C12 Aliphatics	21	0.69	10	4.3	2.5	0.65	3.9	9.82	15	6.4	6.4
C9 - C10 Aromatics	15	0.49	7	0.65	1.25	0.65	1.15	16.5	1.75	13	1.8
EPH RANGES (mg/Kg)*											
C9 - C18 Aliphatics	298	9.9	139	22	27.5	18.5	120	82.5	270	50	41.5
C19 -C36 Aliphatics	3640	120	1700	68	360	260	830	1950	1600	50	240
C11 - C22 Aromatics	1130	37	530	22	240	140	190	550	450	50	110

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

TABLE 13
EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RI

SAMPLE ID		MAX	95%	
SAMPLE LOCATION	AVERAGE[1]	DETECT	UCL	EPC[2]
ANALYTES				
TPH (mg/Kg)[3]	N/A	N/A	N/A	N/A
VPH RANGES (mg/Kg)*				
C5 - C8 Aliphatics	N/A	N/A	N/A	N/A
C9 - C12 Aliphatics	7.3	21	29	21
C9 - C10 Aromatics	5.4	17	24	17
EPH RANGES (mg/Kg)*				
C9 - C18 Aliphatics	98	298	343	298
C19 -C36 Aliphatics	983	3640	5763	3640
C11 - C22 Aromatics	314	1130	1361	1130

NOTES:
TPH = Total Petroleum Hydrocarb
VPH = Volatile Petroleum Hydroc
EPH = Extractable Petroleum Hyd
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence
EPC = Exposure point concentrati
N/A = Not applicable
[1] The average represents the arit
[2] THE EPC is the lesser of the m
[3] The EPC for TPH is not calculat
* Values for 1995 data have been

TABLE 14
EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SUBSURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RI

SAMPLE ID	EX570704	EX570804	EX570905	EX571305	EX571406	EX571502	EX571602	EX571802	EX571902	EX572005	SF570302	SF570503
SAMPLE LOCATION	57E-95-07X	57E-95-08X	57E-95-09X	57E-95-13X	57E-95-14X	57E-95-15X	57E-95-16X	57E-95-18X	57E-95-19X	57E-95-20X	57S-98-03F	57S-98-05F
ANALYTES												
TPH (mg/Kg)	31,800	58	79	<28	49	26,100	30,000	50	130	63	14,800	1750
VPH RANGES (mg/Kg)												
C5 - C8 Aliphatics	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C9 - C12 Aliphatics	130	0.23	0.32	0.06	0.2	106	122	0.2	0.53	0.25	1.9	2.1
C9 - C10 Aromatics	93	0.17	0.23	0.04	0.14	76	88	0.14	0.38	0.18	<1.6	<1.0
EPH RANGES (mg/Kg)												
C9 - C18 Aliphatics	1855	3.4	4.6	0.82	2.9	1523	1750	2.9	7.6	3.6	110	<33
C19 -C36 Aliphatics	22,700	41	56	10	35	18,600	21,400	35	93	45	3300	610
C11 - C22 Aromatics	7050	13	18	3.1	11	5786	6651	11	29	14	990	140

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 14
EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SUBSURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RI

SAMPLE ID SAMPLE LOCATION	AVERAGE[1]	MAX DETECT	95% UCL	EPC[2]
ANALYTES				
TPH (mg/Kg)	N/A	N/A	N/A	N/A
VPH RANGES (mg/Kg)				
C5 - C8 Aliphatics	N/A	N/A	N/A	N/A
C9 - C12 Aliphatics	364	130	33,200	130
C9 - C10 Aromatics	22	93	22,200	93
EPH RANGES (mg/Kg)				
C9 - C18 Aliphatics	440	1855	625,000	1855
C19 -C36 Aliphatics	5577	22,700	12,200,000	22,700
C11 - C22 Aromatics	1726	7050	3,510,000	7050

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocar
VPH = Volatile Petroleum Hydro
EPH = Extractable Petroleum Hy
N/A = Not applicable
mg/Kg = milligrams per kilogram
FOD = Frequency of detection
[1] The average represents the ar

TABLE 15

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RI

SAMPLE ID	BX570800	BX570900	EX57W05X	EX57W10X	EX57W02X	EX57W17X		MAX	95%	
SAMPLE LOCATION	57B-95-08X	57B-95-09X					AVERAGE[1]	DETECT	UCL	EPC[2]
ANALYTES										
TPH (mg/Kg)[3]	50	39	ND	ND	ND	ND	N/A	N/A	N/A	N/A
VPH RANGES (mg/Kg)*										
C5 - C8 Aliphatics	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	N/A
C9 - C12 Aliphatics	1.7	1.3	2.35	1.92	2.68	16	4.33	16	NC	16
C9 - C10 Aromatics	0.7	0.55	2.35	1.92	4.85	2	2.06	4.85	NC	4.85
EPH RANGES (mg/Kg)*										
C9 - C18 Aliphatics	3.2	2.5	3.2	3.48	3.63	1.8	2.97	3.63	NC	3.63
C19 -C36 Aliphatics	38	30	3.2	3.48	7.28	2.4	14	38	NC	38
C11 - C22 Aromatics	6.2	4.9	8.5	3.48	9.75	9.5	7.06	9.75	NC	9.75

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = *Extractable Petroleum Hydrocarbons*
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
1 The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
2 THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
3 The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for *1995 data have been calculated from EPH/VPH compositional data. See Table @.*

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TABLE 16

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SUBSURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RI

SAMPLE ID	BX570805	BX570905	BX571110	EX57W06X	EX57W07X	EX57W08X	EX57W09X	EX57F01X	EX57F02X		MAX	95%	
SAMPLE LOCATION	57B-96-08X	57B-96-09X	57B-96-11X (+dup)							AVERAGE[1]	DETECT	UCL	EPC[2]
ANALYTES													
TPH (mg/Kg)[3]	14*	14*	25	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	N/A
VPH RANGES (mg/Kg)*													
C5 - C8 Aliphatics	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	N/A
C9 - C12 Aliphatics	0.47	0.47	0.84	2.3	2.25	2.25	1.85	2.3	2.3	1.67	2.3	NC	2.3
C9 - C10 Aromatics	0.19	0.19	0.35	2.3	2.25	2.25	1.85	2.3	2.3	1.55	2.3	NC	2.3
EPH RANGES (mg/Kg)*													
C9 - C18 Aliphatics	0.9	0.9	1.6	3.2	9	3.15	3.15	78	3.8	12	78	NC	78
C19 -C36 Aliphatics	11	11	19	20	440	10	3.15	990	12	168	990	NC	990
C11 - C22 Aromatics	1.7	1.7	3.1	8.5	37	8.5	8.5	110	10	21	110	NC	110

NOTES:
* This value represents 1/2 the non-detect value.
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

TABLE 17

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 3 RECREATIONAL
AOC 57 RI

SAMPLE ID	SF571301	SF571401	EX5703X	EX57W14X	EX57W15X	EX57W16X		MAX	95%	
SAMPLE LOCATION	57S-98-13F	57S-98-14F					AVERAGE[1]	DETECT	UCL	EPC[2]
ANALYTES										
TPH (mg/Kg)[3]	951	895	ND	ND	ND	ND	N/A	N/A	N/A	N/A
VPH RANGES (mg/Kg)*										
C5 - C8 Aliphatics	ND	ND	ND	ND	ND	ND	N/A	N/A	N/A	N/A
C9 - C12 Aliphatics	3.7	0.7	47	110	2.85	1500	277	1500	NC	1500
C9 - C10 Aromatics	0.9	0.7	37	55	2.85	600	116	600	NC	600
EPH RANGES (mg/Kg)*										
C9 - C18 Aliphatics	23	20	3.75	920	765	1300	505	1300	NC	1300
C19 -C36 Aliphatics	180	150	3.75	20,000	7200	8600	6020	20,000	NC	20,000
C11 - C22 Aromatics	60	75	10	3100	1200	1400	974	3100	NC	3100

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

N-3 SOIL ADHERENCE FACTOR CALCULATONS

Table N-3
Calculation of Soil Adherence Factors

Receptor	Representative Scenario [1]	Soil Adherence (mg/cm2) [1] Hands	Arms	Legs	Faces	Feet	Surface Area-Weighted AF (mg/cm^2) [2]	Total Surface Area (cm^2) [2]
Adult Excavation Worker	Construction/Utility/ Equipment [5]	0.32	0.3	0.066	0.23	NA	0.29	5200
Adult Commercial Worker	Groundskeepers [6]	0.098	0.022	0.001	0.01	0.018	0.016	12731
Adult Maintenance Worker / Groundskeeper	Irrigation Installers	0.19	0.018	0.0054	0.0063	NA	0.024	11600
Child Resident	USEPA, 1998 [7]						1	2045
Recreational Visitor (6 thru 16)	(8)						1	3850
Adult Resident	USEPA, 1998 [7]						0.08	5800
Body Surface Areas (cm^2) [3]		Hands	Arms	Legs	Faces	Feet	Total Surface Area	
Adult		990	2910	6400	1300	1131	12731	
Child (ages 6 -16)		687	1752	4035	910	989	8373	

Notes:

1 - Kissel, J.; Richter, K.; Fenske,R. (1996). Field measurements of dermal soil loading attributable to various activities: Implications for Exposure Assessment. Risk Anal. 16(1):115-125. Data excerpted from the Exposure Factors Handbook (USEPA, 1997. EPA\600\P-95\002F)

2 - Calculated as: Sum[(SAi...SA*n* x AFi...AF*n*) / Sum (SAi...SA*n*), where AF is AF presented in scenario, and SA is for body part associated with AF measurement

3 - From Exposure Factors Handbook (USEPA, 1997). All values are 50% percentile values for males. Values for children are averages for the age periods included in receptor scenario.

4 - AF values for this scenario are higher than AF values for Gardners No. 2

5 - For each body part, the highest dermal loading value among construction worker, utility worker, and equipment operator scenarios is selected. The dermal loading for legs was not included because dermal loading was only measured (soil was only present) on legs in one scenario.

6 - For each body part, the highest dermal loading value among Groundskeepers Nos. 2 through 5 is selected; values for Groundskeepers No. 1 are not used because the measurements are based on only 2 persons.

7 - Values recommended for residential exposures in Supplemental Guidance to RAGS - Dermal Exposure Assessment (USEPA, 1998)

8 - Assumes adherence factor for child resident (USEPA, 1998). Surface area is for arms, lower legs, and hands.

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N-4 TOXICITY PROFILES

1,2-Dichloroethene. 1,2-Dichloroethene is a volatile organic compound which exists as cis- and trans-isomers. The commercially used material is usually a mixture of the two isomers. In the past, it was used as a general inhalation anesthetic. It is currently used as an extraction solvent or as a component of dyes, perfume oils, waxes, resins, and plastics. It is also used as an intermediate in the synthesis of polymers.

1,2-Dichloroethene is absorbed by all routes of administration. Distribution is rapid and, due to its lipophilic nature, occurs to all organ systems. It is extensively metabolized to dichloroacetaldehyde and chloroacetic acids which are excreted primarily through urine.

Dermal contact to 1,2-dichloroethene may result in defatting of the skin and dermatitis. Exposure to airborne 1,2-dichloroethene causes irritation to eyes, mucous membranes and the upper respiratory tract. Systemically, the trans-isomer is believed to be more toxic than the cis-isomer. However, both have been reported to produce central nervous system depression and toxicity to liver and lungs. No data on the reproductive toxicity of 1,2-dichloroethene exists. Both isomers have tested negative for mutagenicity in vitro tests. Cancer effects have not been studied in humans or animals.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1990. "Toxicological Profile for 1,2-Dichloroethene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1990.

Mycroft, F.J., Jones, J.R., and Olson, K.R. 1990. Environmental and Occupational Toxicology. In: Poisoning and Drug Overdose. Ed. K.R. Olson. Appleton & Lange, CT. p. 397.

1,2/1,4-Dichlorobenzene. 1,4-Dichlorobenzene has been used as mothballs, an insecticidal fumigant, a germicide, and a space deodorant. Human exposure to 1,4-dichlorobenzene has produced irritation to skin, throat, and eyes; prolonged exposure to high concentrations may cause weakness, dizziness, loss of weight, or liver injury. In several studies involving female rats and mice, no overt signs of toxicity were apparent at any exposure level. Non-tumor and tumor pathology did not indicate any treatment related effect of either species. An embryotoxicity and teratology study on rats did not demonstrate any signs of embryo- or phytotoxicity or teratogenicity at any exposure level (Loeser, 1983). In a series of mutagenicity tests, 1,4-dichlorobenzene did not produce a mutagenic response. (Loeser, 1983). Other exposure studies in rats have produced developmental abnormalities, phytotoxicity, and kidney tumors. Additional exposure studies in animals have produced histological changes in the lung, cirrhosis and necrosis of the liver, swelling of the tubular epithelium of the kidneys. 1,4-dichlorobenzene has been classified by the USEPA as a group C carcinogen, possibly carcinogenic to humans.

References:

Heath Effects Summary Tables (HEAST), 1993. United States Environmental Protection Agency.

Loeser E, Litchfield MH; Food Chem Toxicol 21 (6): 825-32 (1983)

Aluminum. Aluminum occurs naturally in the soil and makes up approximately 8 percent of the earths crust. Higher soil concentrations are associated with industries which burn coal and aluminum mining and smelting. Human exposures to aluminum may occur through ingestion of foods grown in soil that contains aluminum and use of antacids, antiperspirants, and other drug store items. Aluminum in antiperspirants can cause skin rashes in some people. Factory workers who inhale large amounts of aluminum dust may develop lung problems. Aluminum has caused lower birth weights in some animals. Studies have shown that aluminum accumulates in the brains of people with Alzheimer's disease. However, any causal link between aluminum exposure and this disease is yet to be demonstrated. Both human epidemiological studies and animal experiments strongly suggests that aluminum is not a carcinogen.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1989. "Toxicological Profile for Aluminum"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October 1989.

Antimony. Antimony enters the environment during the mining and processing of its ores and other related compounds. Small amounts of antimony are also released into the environment by incinerators and coal burning power plants. Antimony will strongly adhere to soil which contains iron, manganese, or aluminum. Antimony was used for medicinal purposes to treat people infected with parasites. However, chronic exposure can cause eye, skin, and lung irritation, as well as heart problems, vomiting and diarrhea. The oral RfD, based on an oral drinking water study in rats, showed changes in glucose and cholesterol metabolism. Antimony has not been evaluated by the USEPA for evidence of human carcinogenic potential.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1991. "Toxicological Profile for Antimony"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1991.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Aroclors. Aroclors (polychlorinated biphenyls [PCBs]) are organic compounds composed of two chlorinated aromatic rings. The amount of chlorination of the rings determines the specific structure, or congener, of the aroclor and, subsequently, the specific chemical, physical, and toxicological properties. The excellent dielectric properties, thermal stability, and nonflamability of aroclors has made them ideal for use in electrical transformers and capacitors. Therefore, they have been used in these applications extensively in the past. Humans may be exposed to aroclors when an aroclor-containing electrical component burns or is dismantled. Although the production of aroclors in the U.S. was banned in 1977, aroclors do not readily breakdown, and they may still be present in older electrical equipment, and environmental media.

Following dermal exposure, aroclors have caused a skin rash called chloracne. Aroclors have also produced developmental defects in humans, which have mainly consisted of behavioral abnormalities. These effects have also been observed in animals. Epidemiological studies on occupationally-exposed humans do not conclusively link exposure to aroclors with an increased incidence of cancer. However, chronic oral exposure to aroclors has produced liver cancer in laboratory animals. The potency of the carcinogenic action of aroclors appears to increase as the chlorination of the aroclors increases. Although cancer in laboratory animals has only been conclusively demonstrated for aroclors with the highest percent chlorination (aroclors-1260 and 1254), the USEPA has classified all aroclor congeners as B2, probable human carcinogens.

References:

MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

Arsenic. Arsenic has been used in pesticide formulations and has industrial uses in tanneries, as well as the glass and wine making industries. Toxicity depends on its chemical form. Arsenic is an irritant of the skin, mucous membranes, and gastrointestinal tract. Symptoms of acute toxicity include vomiting, diarrhea, convulsions, and a severe drop in blood pressure. Subchronic effects include hyperpigmentation, sensory-motor polyneuropathy, persistent headache, and lethargy. Chronic oral exposure has caused skin lesions, peripheral vascular disease, and peripheral neuropathy. The USEPA has classified arsenic in Group A, human carcinogen, based on increased incidence of lung cancer in occupational studies.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1992. "Toxicological Profile for Arsenic"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1992.

Barium. Barium is used in paints, soap, paper, rubber, and in the manufacture of glass. Some compounds of barium have been used as insecticides. Acute exposure to barium through ingestion can cause gastroenteritis, muscular paralysis, as well as cardiovascular effects. Chronic inhalation of barium containing dust can cause a reversible, benign pneumoconiosis. There is no evidence for carcinogenicity for barium.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Benzo(k)fluoranthene. Benzo(k)fluoranthene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also manmade. Benzo(k)fluoranthene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material.

Although there are no human data that specifically link exposure to benzo(k)fluoranthene to human cancers, benzo(k)fluoranthene is a component of mixtures that have been associated with human cancer. These include coal tar, soots, coke oven emissions and cigarette smoke. Benzo(k)fluoranthene produced tumors after lung implantation in mice and when administered with a promoting agent in skin-painting studies. Benzo(k)fluoranthene is mutagenic in bacteria. Benzo(k)fluoranthene has been classified by USEPA as a B2, probable human carcinogen.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

Bis(2-ethylhexyl)phthalate (DEHP). DEHP is used industrially as a plasticizer for resins and is found in many plastic materials as it makes them more flexible. It is also used in manufacturing organic pump fluids in electrical capacitors. Acute exposure to DEHP has produced eye and mucous membrane irritation, nausea, and diarrhea. Chronic exposure of laboratory animals to DEHP indicate that the target organs are the liver, causing morphological and biochemical changes, as well as the testes, producing damage to the seminiferous tubules. DEHP has produced developmental and reproductive effects in laboratory animals including spina bifida and reduced fertility. DEHP has been shown to cause a dose-related increase in liver tumors in mice and rats. Thus, the USEPA has designated DEHP as a B2, probable human carcinogen.

References:
ATSDR, 1991. Toxicological Profile for Di(2-ethylhexyl)phthalate. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1991.

Cadmium. Cadmium is commonly used in electroplating and galvanizing due to its non-corrosive properties. It is a local respiratory tract irritant following exposure to cadmium dust or fumes. Acute exposure to cadmium dust/fumes may produce an acute chemical pneumonitis. Acute, oral exposure to cadmium results in nausea, vomiting, salivation, abdominal pain, cramps, and diarrhea. Chronic exposure to cadmium results in osteomalacia and osteoporosis (Itai-Itai disease) secondary to renal damage. The USEPA has classified cadmium as a B1 carcinogen via inhalation based on epidemiological data from Japan and China.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Carbon Tetrachloride

Carbon tetrachloride is currently used as a fumigant, refrigerant, a propellant, and as a solvent for oil, fats, lacquers, varnishes, rubber, waxes, and resins. In the past, it was used as an industrial degreaser and a fire-extinguishing agent. Acute exposure is associated with dizziness, headache, confusion, and CNS depression. Liver and kidney damage result from chronic exposures. Symptoms of liver damage can include nausea, vomiting, enlarged and tender liver, jaundice, and fatty liver. Kidney failure, resulting in accumulation of waste products in the blood and water in the lungs is a

major cause of death from carbon tetrachloride. The liver and kidney have also been proven to be targets of toxicity in animals. Carbon tetrachloride has been designated as a B2, probable human carcinogen.

References:

Clayton, George D. and Florence E. Clayton, editors, 1981. Patty's Industrial Hygiene and Toxicology, 3rd Revised Edition; John Wiley & Sons; New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Chloroform. Originally used as a general anesthetic, chloroform is used now in the production of air conditioning coolant, as a solvent, and in the manufacture of pesticides and dyes. It can also be found in dry cleaning agents, plastics, and floor polishes, and as a by product of drinking water purification. Acute exposure to chloroform via inhalation produced dizziness and gastrointestinal upset. Dermal contact with chloroform produces burns. It is a CNS depressant and chronic exposure has been shown to cause liver and kidney toxicity as well as cardiac arrhythmias. Several studies indicate that chloroform is carcinogenic via the oral route causing liver carcinoma in mice and kidney tumors. The USEPA has designated chloroform as a B2 carcinogen, a probable human carcinogen.

References:

Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Chromium. Chromium has been used in plating for corrosion resistance and decorative purposes, in the manufacture of alloys, and in printing, dying, and photography. The toxicity of chromium depends upon its valence state. Hexavalent chromium is more toxic via inhalation than trivalent chromium. The effects of inhalation exposure to hexavalent chromium include ulcers of the upper respiratory tract, nasal inflammation, perforation of the nasal septa and lung cancer. Most trivalent chromium compounds are inactive in short-term genotoxicity assays. Trivalent chromium compounds have not been found to be carcinogenic by any route of exposure. There is epidemiological evidence of an association between chromium and lung cancer. The USEPA has classified hexavalent chromium as an Class A, human carcinogen, by the inhalation route.

References:

Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

Copper. Copper is widely distributed in nature and is an essential element. Copper deficiency is characterized by anemia and is used for medicinal purposes as an emetic and an astringent. Acute exposure to copper ingestion causes vomiting, hematesis, hypotension, coma, and jaundice. Chronic exposure of children to elevated concentrations of copper causes liver cirrhosis. Copper is not believed to be a human carcinogen.

References:

Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Dieldrin. Dieldrin is a man-made chlorinated insecticide that was widely used in agriculture, and for termite-proofing of wooden building material and residential dwellings, until it was banned for use in the U.S. in 1974. However, it is highly persistent in the environment and bioaccumulates in terrestrial and aquatic food chains. This, combined with extensive past use, has made dieldrin ubiquitous in the environment. Humans may be exposed to dieldrin from

consumption of animal and agricultural products exposed to contaminated soil and from exposure associated with the use of dieldrin as a termite-proofing agent.

Exposure to high levels of dieldrin has been associated with central nervous system excitation that resulted in convulsions, and renal toxicity. Long-term low-level exposure to dieldrin has also been associated with occasional cases of nervous system intoxication. In addition, hepatic degeneration, immunosuppression, and possible reproductive/developmental toxicity have been observed in laboratory animals exposed to dieldrin. Chronic oral exposure to dieldrin has produced liver cancer in laboratory mice and rats. Epidemiological investigations have been of insufficient quality to assess dieldrin carcinogenicity in humans. Based on animal data, the USEPA has placed dieldrin into group B2, probable human carcinogen.

References
Agency for Toxic Substances and Disease Registry (ATSDR), 1991. "Toxicological Profile for Aldrin/Dieldrin"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October 1991.

Iron. Iron is a metal which is required for a variety of physiological functions such as heme biosynthesis, oxidative phosphorylation and mixed-function oxidase-mediated metabolic reactions. Only divalent forms of iron are absorbed. As absorption occurs, divalent iron is biochemically converted to trivalent iron, the biologically active form. Under normal conditions, absorbed dietary iron is complexed to hemoglobin and transported to the liver for storage until needed for physiological reactions. The balance of iron is regulated only by the amount of dietary intake and the degree of intestinal absorption. Intestinal absorption tends to be low (2 - 15%) except during periods of increased iron need when absorption efficiency increases dramatically.

Acute iron toxicity has been well characterized following the accidental ingestion of iron-containing preparations by children. Shortly after ingestion, the corrosive effects of iron cause vomiting and diarrhea, often bloody. Later signs include shock, metabolic acidosis, seizures, liver and/or kidney failure, coma, and death. Chronic iron overload manifests as disturbances in liver function, diabetes mellitus, and endocrine and cardiovascular effects. Inhalation of iron containing dust or fumes in occupational settings may result in deposition of iron particles in the lungs leading to interstitial fibrosis. Autopsies of hematite miners noted an increase in lung cancer. However, the etiology of the lung cancer may be related to factors other than iron exposure such as cigarette, silica or PAH exposures.

References:
Aisen, P., Cohen, G. and Kang, J.O., 1990. Iron Toxicosis. Int. Rev. Exp. Pathol. 31:1-46.

Goyer, R.A., 1991. Toxic Effects of Metals. In: Casarett and Doull's Toxicology: The Basic Science of Poisons, 3rd edition. Eds. C.D. Klaassen, M.O. Amdur and J. Doull. Macmillan Publishing Co. N.Y.

Lead. Lead is used as a component in storage batteries and was widely used in gasoline and paints. It is the most ubiquitous toxic metal in the environment. The most serious effects of chronic exposure are encephalopathy, renal damage, and changes in the hematopoietic system, which is the most sensitive indicator of lead exposure. Peripheral nerve dysfunction is observed in adults at blood lead levels of 30 to 50 mg/dL-blood. The nervous systems of children are reported to be affected at levels of 15 mg/dL-blood (Benignus and others, 1981). Chronic lead exposure by workers through inhalation has resulted in statistically significant increases in tumors. Oral exposures of lead salts in animals has been shown to increase tumor formation.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Benignus, V.A., Otto, D.A., Muller, K.E., Seiple, K.J., 1981. "Effects of Age and Body Lead Burden on CNS Function in Young Children. II:EEG Spectra." Electroencephalograph. Clin. Neurophysiol. 52:240-248.

Manganese. Manganese is a naturally occurring substance found in many types of rock. It does not generally occur in the environment as the pure metal, rather, it is found combined with other chemicals such as sulfur, oxygen, and chlorine. Manganese is mixed with iron to make various types of steel. Manganese is a component of some ceramics, pesticides, fertilizers, and in nutritional supplements. In small doses manganese is beneficial to human health. Manganese miners and steel workers exposed to elevated concentrations of manganese have evidenced mental and emotional disturbances, and slow and clumsy body movements. Target organs of manganese are the lung and CNS. When inhaled, manganese dust can also cause lung irritation. EPA has classified manganese as a Class D, not classifiable as to human carcinogenicity.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1991. "Toxicological Profile for Manganese"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1991.

Naphthalene. Naphthalene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also manmade. Naphthalene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. It is also product of pyrolysis in tobacco smoke. Naphthalene is used for the production of phthalic anhydride, which is used for the production of plasticizers. Naphthalene is also used in moth balls, for the production of the insecticide carbaryl, and in numerous resins, dyes, pharmaceuticals, and other organic materials.

Naphthalene is absorbed through the inhalation, oral, and dermal routes, and appears to be more toxic to humans than laboratory animals. The principal toxic effect of naphthalene in humans and animals is hemolysis of red blood cells, which can lead to anemia, decreased oxygen carrying capacity, and jaundice. Humans pre-disposed to anemia, such as those with G6DP enzyme deficiency, may be particularly sensitive to naphthalene toxicity. Exposure to naphthalene has also been correlated with increased risk of cataract formation. Animal studies were negative for naphthalene reproductive toxicity. Although no human epidemiological data are available for assessing naphthalene carcinogenicity, animal data investigating naphthalene toxicity are equivocal. The USEPA has placed naphthalene in weight-of-evidence Group D, not classifiable as to human carcinogenicity.

References:

Agency for Toxic Substances and Disease Registry (ATSDR), 1990. "Toxicological Profile for Naphthalene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. October, 1990.

Tetrachloroethene (Perchlorethene). Tetrachloroethene is a man-made volatile chlorinated solvent that is used extensively in the textile and dry cleaning industries as a cleanser and degreaser. Tetrachloroethene is also used as a degreaser in the electronics and metal industry. Since tetrachloroethene effectively cleans and decreases without adversely affecting what is being cleansed, tetrachloroethene is used extensively in a multitude of commercially available cleansers.

Tetrachloroethene is nearly completely absorbed via the inhalation and oral routes; dermal exposure represents a minor pathway. Oral and inhalation exposure to tetrachloroethene in humans and animals indicates that the liver, kidney, and nervous system are target organs. Long-term exposures to tetrachloroethene produced proliferative changes in the mouse livers, renal nephropathy in animals and occupationally exposed workers, and irreversible nervous system damage in laboratory animals. Additionally, an increased incidence of menstrual disorders and spontaneous abortions have been observed in women occupationally exposed to tetrachloroethene in the dry cleaning business. Epidemiological data in humans is insufficient to make conclusions regarding the potential carcinogenicity of tetrachloroethene. However, tetrachloroethene has produced hepatic cancer in laboratory animals exposed orally and by inhalation. Therefore, the USEPA has placed tetrachloroethene in weight-of-evidence group B2, probable human carcinogen.

References:.

Agency for Toxic Substances and Disease Registry (ATSDR), 1991. "Toxicological Profile for Tetrachloroethene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. October, 1991.

Trichloroethene. Trichloroethene is a man-made chlorinated solvent that is used extensively in industry as a metal decreasing agent. Trichloroethene is also used in dry cleaning and as a solvent in paints and adhesives.

Several human deaths and acute neurotoxic effects have been attributed to oral and inhalation exposure to trichloroethene. In animals, oral and inhalation exposure to trichloroethene have produce neurotoxic effects, including behavioral changes, and renal toxicity. Additionally, inhalation and oral exposures to trichloroethene in animals have produced lung, liver, and testicular cancers. Epidemiological data in humans is insufficient to conclude whether trichloroethene is a human carcinogen. However, studies on trichloroethene metabolism suggest that it is metabolized similarly
in humans and laboratory animals. Therefore, the USEPA has place trichloroethene in weight-of-evidence group B2, probable human carcinogen.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

Vanadium. Vanadium is widely, but sparsely, distributed in the earth's crust and in the environment. It is invaluable as an alloying agent with steel; ferrovanadium alloys are used in high-stress applications such as bearings, jet engines, and cutting tools. Human and animal studies indicate that vanadium is readily absorbed from the lungs and poorly absorbed from the gastrointestinal tract. It distributes primarily to the bone and kidney. Vanadium is a respiratory irritant. Inhalation of vanadium dusts in both animals and occupationally-exposed workers induces mild to moderate respiratory irritation. The effects are reversible and subside when exposure is discontinued. No studies were located regarding cancer in humans or animals following inhalation, oral, or dermal exposures. However, vanadium has been found to induce DNA damage in human cell cultures, suggesting that vanadium may have the potential to be genotoxic to humans.

References:
ATSDR, 1990. Toxicological Profile for Vanadium. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1990.

VPH/EPH FRACTIONS

Chemical surrogates were chosen to represent the different aliphatic and aromatic fractions of TPH. Appropriate surrogates are referenced below for each fraction.

C5-C8 Aliphatics. n-Hexane is the reference compound for the TPH fraction containing C5-C8 alkanes/cycloalkanes. Through epidemiological studies on n-hexane-exposed workers, sensorimotor polyneuropathy has been observed as the main toxic effect of long-term exposure. Other noted effects include cranial neuropathy, blurred vision, and abnormal color vision. The onset of symptoms may be delayed for several months to a year after exposure. Affected individuals may recover completely, but some may retain sensorimotor deficits. A number of animal studies have been conducted that document n-hexane's neuropathic effects.

Reference:
MADEP, 1994. Interim Final Petroleum Report: Development of Health-Based Alternative to the Total Petroleum Hydrocarbon (TPH) Parameter. August.

C9-C12 Aliphatics. See profile for n-Hexane provided for C5-C8 Aliphatics above.

C9-C18 Aliphatics. See profile for n-Hexane provided for C5-C8 Aliphatics above.

C19-C36 Aliphatics. See profile for n-Hexane provided for C5-C8 Aliphatics above.

C9-C10 Aromatics. See profile for pyrene and profile for xylene below.

Xylenes. Xylene is a volatile organic compound that is generally composed of a mixture of the meta, ortho, and para isomers. Xylenes are used as solvents, in paints, thinners, cleaners, degreasers, and as a component in gasoline.

Xylenes are absorbed by oral, inhalation, and dermal exposures, and distribute to all tissues, particularly those with high fat contents. All three isomers produce similar effects, although the potency with which various effects are produced may vary from effect to effect with each isomer. In both humans and animals, xylene exposure has been associated with central nervous system depression, impaired learning and memory, and tremors. In humans, inhalation of xylene may produce prolonged respiratory tract inflammation and edema. In laboratory animals, exposures to xylenes have produced adverse reproductive effects, including increased fetal death rate and retarded development. There is no evidence of carcinogenicity in humans or animals.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

C10-C22 Aromatics. See profiles for naphthalene and pyrene.

Naphthalene. Naphthalene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds, which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also man-made. Naphthalene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. It is also product of pyrolysis in tobacco smoke. Naphthalene is used for the production of phthalic anhydride, which is used for the production of plasticizers. Naphthalene is also used in moth balls, for the production of the insecticide carbaryl, and in numerous resins, dyes, pharmaceuticals, and other organic materials.

Naphthalene is absorbed through the inhalation, oral, and dermal routes, and appears to be more toxic to humans than laboratory animals. The principal toxic effect of naphthalene in humans and animals is hemolysis of red blood cells, which can lead to anemia, decreased oxygen-carrying capacity, and jaundice. Humans pre-disposed to anemia, such as those with G6DP enzyme deficiency, may be particularly sensitive to naphthalene toxicity. Exposure to naphthalene has also been correlated with increased risk of cataract formation. Animal studies were negative for naphthalene reproductive toxicity. Although no human epidemiological data are available for assessing naphthalene carcinogenicity, animal data investigating naphthalene toxicity are equivocal. The USEPA has placed naphthalene in weight-of-evidence Group D, not classifiable as to human carcinogenicity.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1990. "Toxicological Profile for Naphthalene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. October, 1990.

Pyrene. Pyrene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. They are ubiquitous in nature and are also man made. It occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. Pyrene is reported to be a skin irritant to humans. Rats administered pyrene exhibited blood chemistry changes, as well as liver and kidney damage. Pyrene was shown to be inactive as an initiating agent and thus has been classified as a D carcinogen.

References:
ATSDR, 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1989.

N-5 RISK CALCULATIONS

MAIN-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

August 1992

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.024	mg/cm^2
SURFACE AREA EXPOSED	SA	11,600	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
The exposure frequency is assumed to be 1 day a week from May 1st to Ocober 31st.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

MAIN-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	1.5E-06	0.03	1.3E-07	1.5E+00	1.60E+00	2.3E-06	2.0E-07	2.5E-06	100.00%
					SUMMARY CANCER RISK		2E-06	2E-07	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	4.3E-06	0.03	3.6E-07	3.0E-04	2.9E-04	1.4E-02	1.2E-03	1.5E-02	40.95%
Chromium	27	5.5E-06	ND		3.0E-03	ND	1.8E-03		1.8E-03	4.85%
Iron	16,400	3.3E-03	ND		ND	ND				
Manganese	481	9.8E-05	ND		7.1E-02	ND	1.4E-03		1.4E-03	3.65%
VPH										
C9-C12 Aliphatics	32	6.5E-06	0.17	3.1E-06	6.0E-01	5.5E-01	1.1E-05	5.6E-06	1.6E-05	
C9-C10 Aromatics	23	4.7E-06	0.17	2.2E-06	3.0E-02	2.7E-02	1.6E-04	8.2E-05	2.4E-04	0.63%
EPH										
C9-C18 Aliphatics	465	9.5E-05	0.17	4.5E-05	6.0E-01	5.5E-01	1.6E-04	8.1E-05	2.4E-04	0.63%
C19-C36 Aliphatics	5,680	1.2E-03	0.17	5.5E-04	6.0E+00	5.5E+00	1.9E-04	9.9E-05	2.9E-04	0.77%
C11-C22 Aromatics	1770	3.6E-04	0.17	1.7E-04	3.0E-02	2.7E-02	1.2E-02	6.3E-03	1.8E-02	48.48%
					SUMMARY HAZARD INDEX		0.03	0.008	0.04	

MAIN-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	1.6	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

INTAKE - INHALATION = $\frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

MAIN-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	1.5E-10	1.5E+01	2.2E-09	22.15%
Chromium	27	NA		2.0E-08	1.9E-10	4.1E+01	7.8E-09	77.85%
						SUMMARY CANCER RISK	1E-08	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	4.1E-10	ND		
Chromium	27	NA		2.0E-08	5.3E-10	2.9E-05	1.8E-05	2.63%
Iron	16,400	NA		1.2E-05	3.2E-07	ND		
Manganese	481	NA		3.6E-07	9.5E-09	1.4E-05	6.8E-04	97.11%
VPH								
C9-C12 Aliphatics	32	NA		2.4E-08	6.3E-10	5.7E-01	1.1E-09	0.00016%
C9-C10 Aromatics	23	NA		1.7E-08	4.5E-10	1.7E-02	2.7E-08	0.0038%
EPH								
C9-C18 Aliphatics	465	NA		3.5E-07	9.2E-09	5.7E-01	1.6E-08	0.0023%
C19-C36 Aliphatics	5680	NA		4.3E-06	1.1E-07	ND		
C11-C22 Aromatics	1,770	NA		1.3E-06	3.5E-08	2.0E-02	1.7E-06	0.25%
						SUMMARY HAZARD INDEX	0.0007	

MAIN-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	50	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.024	mg/cm^2
SURFACE AREA EXPOSED	SA	11,600	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	6.6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
The exposure frequency is assumed to be 1 day a week from May 1st to Ocober 31st.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

MAIN-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	1.0E-07	0.03	1.7E-08	1.5E+00	1.60E+00	1.5E-07	2.7E-08	1.8E-07	100.00%
					SUMMARY CANCER RISK		2E-07	3E-08	2E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	1.1E-06	0.03	1.8E-07	3.0E-04	2.9E-04	3.6E-03	6.2E-04	4.2E-03	36.63%
Chromium	27	1.4E-06	ND		3.0E-03	ND	4.6E-04		4.6E-04	4.02%
Iron	16,400	8.3E-04	ND		ND	ND				
Manganese	481	2.4E-05	ND		7.1E-02	ND	3.4E-04		3.4E-04	3.02%
VPH										
C9-C12 Aliphatics	32	1.6E-06	0.17	1.5E-06	6.0E-01	5.5E-01	2.7E-06	2.8E-06	5.5E-06	
C9-C10 Aromatics	23	1.2E-06	0.17	1.1E-06	3.0E-02	2.7E-02	3.9E-05	4.1E-05	8.0E-05	0.70%
EPH										
C9-C18 Aliphatics	465	2.4E-05	0.17	2.2E-05	6.0E-01	5.5E-01	3.9E-05	4.1E-05	8.0E-05	0.70%
C19-C36 Aliphatics	5,680	2.9E-04	0.17	2.7E-04	6.0E+00	5.5E+00	4.8E-05	5.0E-05	9.8E-05	0.86%
C11-C22 Aromatics	1770	9.0E-05	0.17	8.5E-05	3.0E-02	2.7E-02	3.0E-03	3.2E-03	6.2E-03	54.02%
					SUMMARY HAZARD INDEX		0.007	0.004	0.011	

MAIN-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	1.6	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	6.6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

MAIN-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	2.0E-11	1.5E+01	2.9E-10	22.15%
Chromium	27	NA		2.0E-08	2.5E-11	4.1E+01	1.0E-09	77.85%
						SUMMARY CANCER RISK	1E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	2.1E-10	ND		
Chromium	27	NA		2.0E-08	2.7E-10	2.9E-05	9.2E-06	2.63%
Iron	16,400	NA		1.2E-05	1.6E-07	ND		
Manganese	481	NA		3.6E-07	4.7E-09	1.4E-05	3.4E-04	97.11%
VPH								
C9-C12 Aliphatics	32	NA		2.4E-08	3.2E-10	5.7E-01	5.5E-10	0.00016%
C9-C10 Aromatics	23	NA		1.7E-08	2.3E-10	1.7E-02	1.3E-08	0.0038%
EPH								
C9-C18 Aliphatics	465	NA		3.5E-07	4.6E-09	5.7E-01	8.1E-09	0.0023%
C19-C36 Aliphatics	5680	NA		4.3E-06	5.6E-08	ND		
C11-C22 Aromatics	1,770	NA		1.3E-06	1.7E-08	2.0E-02	8.7E-07	0.25%
						SUMMARY HAZARD INDEX	0.0003	

C…W-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.016	mg/cm^2
SURFACE AREA EXPOSED	SA	12,731	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

CWIW-SS2I

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME

FUTURE COMMERCIAL/INDUSTRIAL WORKER

AOC 57 AREA 2 INDUSTRIAL

FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	4.4E-06	0.03	2.7E-07	1.5E+00	1.60E+00	6.6E-06	4.3E-07	7.0E-06	100.00%
					SUMMARY CANCER RISK		7E-06	4E-07	7E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	1.2E-05	0.03	7.5E-07	3.0E-04	2.9E-04	4.1E-02	2.6E-03	4.4E-02	44.36%
Chromium	27	1.6E-05	ND		2.0E-02	ND	7.9E-04		7.9E-04	0.80%
Iron	16,400	9.6E-03	ND		ND	ND				
Manganese	481	2.8E-04	ND		7.1E-02	ND	4.0E-03		4.0E-03	4.04%
VPH										
C9-C12 Aliphatics	32	1.9E-05	0.17	6.5E-06	6.0E-01	5.5E-01	3.1E-05	1.2E-05	4.3E-05	0.04%
C9-C10 Aromatics	23	1.4E-05	0.17	4.7E-06	3.0E-02	2.7E-02	4.5E-04	1.7E-04	6.2E-04	0.63%
EPH										
C9-C18 Aliphatics	465	2.7E-04	0.17	9.5E-05	6.0E-01	5.5E-01	4.5E-04	1.7E-04	6.3E-04	0.64%
C19-C36 Aliphatics	5,680	3.3E-03	0.17	1.2E-03	6.0E+00	5.5E+00	5.6E-04	2.1E-04	7.7E-04	0.78%
C11-C22 Aromatics	1770	1.0E-03	0.17	3.6E-04	3.0E-02	2.7E-02	3.5E-02	1.3E-02	4.8E-02	48.70%
					SUMMARY HAZARD INDEX		0.08	0.02	0.10	

CWIW-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

16-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m³
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m³
VOLATILIZATION FACTOR**	VF	Calculated	m³/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m³
INHALATION RATE	IhR	1.6	m³/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + CAv) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CWIW-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	4.3E-10	1.5E+01	6.4E-09	22.15%
Chromium	27	NA		2.0E-08	5.5E-10	4.1E+01	2.3E-08	77.85%
						SUMMARY CANCER RISK	3E-08	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	1.2E-09	ND		
Chromium	27	NA		2.0E-08	1.5E-09	2.9E-05	5.3E-05	2.63%
Iron	16,400	NA		1.2E-05	9.3E-07	ND		
Manganese	481	NA		3.6E-07	2.7E-08	1.4E-05	2.0E-03	97.11%
VPH								
C9-C12 Aliphatics	32	NA		2.4E-08	1.8E-09	5.7E-01	3.2E-09	0.00016%
C9-C10 Aromatics	23	NA		1.7E-08	1.3E-09	1.7E-02	7.7E-08	0.0038%
EPH								
C9-C18 Aliphatics	465	NA		3.5E-07	2.6E-08	5.7E-01	4.6E-08	0.0023%
C19-C36 Aliphatics	5680	NA		4.3E-06	3.2E-07	ND		
C11-C22 Aromatics	1,770	NA		1.3E-06	1.0E-07	2.0E-02	5.0E-06	0.25%
						SUMMARY HAZARD INDEX	0.002	

CWIW-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	50	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.016	mg/cm^2
SURFACE AREA EXPOSED	SA	13,731	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6.6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CWIW-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR		CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
					ORAL (mg/kg-day)-1	DERMAL (mg/kg-day)-1				
Arsenic	21	5.8E-07	0.03	7.7E-08	1.5E+00	1.60E+00	8.7E-07	1.2E-07	9.9E-07	100.00%
					SUMMARY CANCER RISK		9E-07	1E-07	1E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE		HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
					ORAL (mg/kg-day)	DERMAL (mg/kg-day)				
Arsenic	21	6.2E-06	0.03	8.1E-07	3.0E-04	2.9E-04	2.1E-02	2.8E-03	2.3E-02	39.72%
Chromium	27	7.9E-06	ND		2.0E-02	ND	4.0E-04		4.0E-04	0.67%
Iron	16,400	4.8E-03	ND		ND	ND				
Manganese	481	1.4E-04	ND		7.1E-02	ND	2.0E-03		2.0E-03	3.38%
VPH										
C9-C12 Aliphatics	32	9.4E-06	0.17	7.0E-06	6.0E-01	5.5E-01	1.6E-05	1.3E-05	2.8E-05	0.05%
C9-C10 Aromatics	23	6.8E-06	0.17	5.0E-06	3.0E-02	2.7E-02	2.3E-04	1.9E-04	4.1E-04	0.70%
EPH										
C9-C18 Aliphatics	465	1.4E-04	0.17	1.0E-04	6.0E-01	5.5E-01	2.3E-04	1.9E-04	4.1E-04	0.70%
C19-C36 Aliphatics	5,680	1.7E-03	0.17	1.2E-03	6.0E+00	5.5E+00	2.8E-04	2.3E-04	5.0E-04	0.86%
C11-C22 Aromatics	1770	5.2E-04	0.17	3.9E-04	3.0E-02	2.7E-02	1.7E-02	1.4E-02	3.2E-02	53.91%
					SUMMARY HAZARD INDEX		0.04	0.02	0.06	

CWIW-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

16-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	1.6	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6.6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + CAv) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CWIW-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	1.1E-10	1.5E+01	1.7E-09	22.15%
Chromium	27	NA		2.0E-08	1.4E-10	4.1E+01	5.9E-09	77.85%
						SUMMARY CANCER RISK	8E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	1.2E-09	ND		
Chromium	27	NA		2.0E-08	1.5E-09	2.9E-05	5.3E-05	2.63%
Iron	16,400	NA		1.2E-05	9.3E-07	ND		
Manganese	481	NA		3.6E-07	2.7E-08	1.4E-05	2.0E-03	97.11%
VPH								
C9-C12 Aliphatics	32	NA		2.4E-08	1.8E-09	5.7E-01	3.2E-09	0.00016%
C9-C10 Aromatics	23	NA		1.7E-08	1.3E-09	1.7E-02	7.7E-08	0.0038%
EPH								
C9-C18 Aliphatics	465	NA		3.5E-07	2.6E-08	5.7E-01	4.6E-08	0.0023%
C19-C36 Aliphatics	5680	NA		4.3E-06	3.2E-07	ND		
C11-C22 Aromatics	1,770	NA		1.3E-06	1.0E-07	2.0E-02	5.0E-06	0.25%
						SUMMARY HAZARD INDEX	0.002	

CWIW-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	chemical-specific	ug/liter
INGESTION RATE	IR	1	liters/day
BODY WEIGHT	BW	70	kg
CONVERSION FACTOR	CF	0.001	mg/ug
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

CWIW-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
No Carcinogenic CPCs					
			TOTAL CANCER RISK		0E+00

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Aluminum	204	ug/Liter	2.0E-03	1.0E+00	2.0E-03
Manganese	177	ug/Liter	1.7E-03	2.4E-02	7.2E-02
			TOTAL HAZARD INDEX		0.07

CW1W-GW2I(CT)
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - CENTRAL TENDENCY
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	chemical-specific	ug/liter
INGESTION RATE	IR	1	liters/day
BODY WEIGHT	BW	70	kg
CONVERSION FACTOR	CF	0.001	mg/ug
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	6.6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

CWIW-GW2I(CT)
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - CENTRAL TENDENCY
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
No Carcinogenic CPCs					
			TOTAL CANCER RISK		0E+00

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Aluminum	204	ug/Liter	2.0E-03	1.0E+00	2.0E-03
Manganese	177	ug/Liter	1.7E-03	2.4E-02	7.2E-02
			TOTAL HAZARD INDEX		0.07

CON-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.5	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

CON-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	7.0E-07	0.03	6.4E-08	1.5E+00	1.60E+00	1.1E-06	1.0E-07	1.2E-06	100.00%
					SUMMARY CANCER RISK		1E-06	1E-07	1E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	9.9E-05	0.03	9.0E-06	3.0E-04	2.9E-04	3.3E-01	3.1E-02	3.6E-01	81.14%
Chromium	27	1.3E-04	ND	0.0E+00	2.0E-02	5.0E-04	6.3E-03	0.0E+00	6.3E-03	1.43%
Iron	16,400	7.7E-02	ND	0.0E+00	ND	ND				
Manganese	481	2.3E-03	ND	0.0E+00	7.1E-02	4.30E-03	3.2E-02	0.0E+00	3.2E-02	7.18%
VPH										
C9-C12 Aliphatics	32	1.5E-04	0.17	7.8E-05	6.0E+00	5.5E+00	2.5E-05	1.4E-05	3.9E-05	0.01%
C9-C10 Aromatics	23	1.1E-04	0.17	5.6E-05	3.0E-01	2.7E-01	3.6E-04	2.1E-04	5.7E-04	0.13%
EPH										
C9-C18 Aliphatics	465	2.2E-03	0.17	1.1E-03	6.0E+00	5.5E+00	3.6E-04	2.0E-04	5.7E-04	0.13%
C19-C36 Aliphatics	5680	2.7E-02	0.17	1.4E-02	6.0E+01	5.5E+01	4.4E-04	2.5E-04	6.9E-04	0.16%
C11-C22 Aromatics	1,770	8.3E-03	0.17	4.3E-03	3.0E-01	2.7E-01	2.8E-02	1.6E-02	4.4E-02	9.83%
				SUMMARY HAZARD INDEX			0.4	0.05	0.4	

CON-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.50	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration

**Volatilization factor used only for volatile chemicals of potential concern.

For noncarcinogenic effects: AT = ED

ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	2.9E-11	1.5E+01	4.4E-10	22.15%
Chromium	27	NA		2.0E-08	3.8E-11	4.1E+01	1.5E-09	77.85%
						SUMMARY CANCER RISK	2E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	4.1E-09	ND		
Chromium	27	NA		2.0E-08	5.3E-09	2.9E-05	1.8E-04	
Iron	16,400	NA		1.2E-05	3.2E-06	ND		
Manganese	481	NA		3.6E-07	9.4E-08	1.4E-05	6.7E-03	97.34%
VPH								
C9-C12 Aliphatics	32	NA		2.4E-08	6.3E-09	5.7E+00	1.1E-09	0.00002%
C9-C10 Aromatics	23	NA		1.7E-08	4.5E-09	1.7E-01	2.6E-08	
EPH								
C9-C18 Aliphatics	465	NA		3.5E-07	9.1E-08	5.7E+00	1.6E-08	
C19-C36 Aliphatics	5680	NA		4.3E-06	1.1E-06	ND		
C11-C22 Aromatics	1,770	NA		1.3E-06	3.5E-07	2.0E-01	1.7E-06	0.025%
						SUMMARY HAZARD INDEX	0.007	

CON-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.5	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.87	3.3E-07	0.03	3.0E-08	1.5E+00	1.60E+00	5.0E-07	4.8E-08	5.4E-07	100.00%
					SUMMARY CANCER RISK		5E-07	5E-08	5E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.87	4.6E-05	0.03	4.2E-06	3.0E-04	2.9E-04	1.5E-01	1.5E-02	1.7E-01	91.33%
Iron	8080	3.8E-02	ND	0.0E+00	ND	ND				
Manganese	231	1.1E-03	ND	0.0E+00	7.1E-02	4.30E-03	1.5E-02	0.0E+00	1.5E-02	8.25%
VPH										
C9-C12 Aliphatics	0.57	2.7E-06	0.17	1.4E-06	6.0E+00	5.5E+00	4.5E-07	2.5E-07	7.0E-07	0.0004%
C9-C10 Aromatics	0.41	1.9E-06	0.17	9.9E-07	3.0E-01	2.7E-01	6.4E-06	3.7E-06	1.0E-05	0.01%
EPH										
C9-C18 Aliphatics	8.2	3.9E-05	0.17	2.0E-05	6.0E+00	5.5E+00	6.4E-06	3.6E-06	1.0E-05	0.01%
C19-C36 Aliphatics	101	4.7E-04	0.17	2.4E-04	6.0E+01	5.5E+01	7.9E-06	4.4E-06	1.2E-05	0.01%
C11-C22 Aromatics	31	1.5E-04	0.17	7.5E-05	3.0E-01	2.7E-01	4.9E-04	2.5E-04	7.4E-04	0.40%
				SUMMARY HAZARD INDEX			0.2	0.01	0.2	

CON-SBZI
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m³
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m³
VOLATILIZATION FACTOR**	VF	Calculated	m³/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m³
INHALATION RATE	IhR	3.3	m³/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.50	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(\text{CAp} + \text{Cav}) \times \text{RAF} \times \text{IhR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT} \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB2I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.87	NA		7.5E-09	1.4E-11	1.5E+01	2.1E-10	100.00%
						SUMMARY CANCER RISK	2E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.87	NA		7.5E-09	1.9E-09	ND		
Iron	8080	NA		6.1E-06	1.6E-06	ND		
Manganese	231	NA		1.8E-07	4.5E-08	1.4E-05	3.2E-03	100.00%
VPH								
C9-C12 Aliphatics	0.57	NA		4.3E-10	1.1E-10	5.7E+00	2.0E-11	0.000001%
C9-C10 Aromatics	0.41	NA		3.1E-10	8.0E-11	1.7E-01	4.7E-10	
EPH								
C9-C18 Aliphatics	8.2	NA		6.2E-09	1.6E-09	5.7E+00	2.8E-10	
C19-C36 Aliphatics	101	NA		7.7E-08	2.0E-08	ND		
C11-C22 Aromatics	31	NA		2.3E-08	6.1E-09	2.0E-01	3.0E-08	0.001%
						SUMMARY HAZARD INDEX	0.003	

C[illegible]-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

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Rev. 8/92

CON-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	3.5E-07	0.03	3.2E-08	1.5E+00	1.60E+00	5.3E-07	5.1E-08	5.8E-07	100.00%
					SUMMARY CANCER RISK		5E-07	5E-08	6E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	9.9E-05	0.03	9.0E-06	3.0E-04	2.9E-04	3.3E-01	3.1E-02	3.6E-01	81.14%
Chromium	27	1.3E-04	ND	0.0E+00	2.0E-02	5.0E-04	6.3E-03	0.0E+00	6.3E-03	1.43%
Iron	16,400	7.7E-02	ND	0.0E+00	ND	ND				
Manganese	481	2.3E-03	ND	0.0E+00	7.1E-02	4.30E-03	3.2E-02	0.0E+00	3.2E-02	7.18%
VPH										
C9-C12 Aliphatics	32	1.5E-04	0.17	7.8E-05	6.0E+00	5.5E+00	2.5E-05	1.4E-05	3.9E-05	0.01%
C9-C10 Aromatics	23	1.1E-04	0.17	5.6E-05	3.0E-01	2.7E-01	3.6E-04	2.1E-04	5.7E-04	0.13%
EPH										
C9-C18 Aliphatics	465	2.2E-03	0.17	1.1E-03	6.0E+00	5.5E+00	3.6E-04	2.0E-04	5.7E-04	0.13%
C19-C36 Aliphatics	5680	2.7E-02	0.17	1.4E-02	6.0E+01	5.5E+01	4.4E-04	2.5E-04	6.9E-04	0.16%
C11-C22 Aromatics	1,770	8.3E-03	0.17	4.3E-03	3.0E-01	2.7E-01	2.8E-02	1.6E-02	4.4E-02	9.83%
					SUMMARY HAZARD INDEX		0.4	0.05	0.4	

CON-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

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Rev. 8/92

CON-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	1.5E-11	1.5E+01	2.2E-10	22.15%
Chromium	27	NA		2.0E-08	1.9E-11	4.1E+01	7.7E-10	77.85%
						SUMMARY CANCER RISK	1E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	4.1E-09	ND		
Chromium	27	NA		2.0E-08	5.3E-09	2.9E-05	1.8E-04	
Iron	16,400	NA		1.2E-05	3.2E-06	ND		
Manganese	481	NA		3.6E-07	9.4E-08	1.4E-05	6.7E-03	97.34%
VPH								
C9-C12 Aliphatics	32	NA		2.4E-08	6.3E-09	5.7E+00	1.1E-09	0.00002%
C9-C10 Aromatics	23	NA		1.7E-08	4.5E-09	1.7E-01	2.6E-08	
EPH								
C9-C18 Aliphatics	465	NA		3.5E-07	9.1E-08	5.7E+00	1.6E-08	
C19-C36 Aliphatics	5680	NA		4.3E-06	1.1E-06	ND		
C11-C22 Aromatics	1,770	NA		1.3E-06	3.5E-07	2.0E-01	1.7E-06	0.025%
						SUMMARY HAZARD INDEX	0.007	

CON-SB2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm²
SURFACE AREA	SA	5200	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

CON-SB2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.87	1.7E-07	0.03	1.5E-08	1.5E+00	1.60E+00	2.5E-07	2.4E-08	2.7E-07	100.00%
					SUMMARY CANCER RISK		2E-07	2E-08	3E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.87	4.6E-05	0.03	4.2E-06	3.0E-04	2.9E-04	1.5E-01	1.5E-02	1.7E-01	91.33%
Iron	8080	3.8E-02	ND	0.0E+00	ND	ND				
Manganese	231	1.1E-03	ND	0.0E+00	7.1E-02	4.30E-03	1.5E-02	0.0E+00	1.5E-02	8.25%
VPH										
C9-C12 Aliphatics	0.57	2.7E-06	0.17	1.4E-06	6.0E+00	5.5E+00	4.5E-07	2.5E-07	7.0E-07	0.0004%
C9-C10 Aromatics	0.41	1.9E-06	0.17	9.9E-07	3.0E-01	2.7E-01	6.4E-06	3.7E-06	1.0E-05	0.01%
EPH										
C9-C18 Aliphatics	8.2	3.9E-05	0.17	2.0E-05	6.0E+00	5.5E+00	6.4E-06	3.6E-06	1.0E-05	0.01%
C19-C36 Aliphatics	101	4.7E-04	0.17	2.4E-04	6.0E+01	5.5E+01	7.9E-06	4.4E-06	1.2E-05	0.01%
C11-C22 Aromatics	31	1.5E-04	0.17	7.5E-05	3.0E-01	2.7E-01	4.9E-04	2.5E-04	7.4E-04	0.40%
				SUMMARY HAZARD INDEX			0.2	0.01	0.2	

CON-SB2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.87	NA		7.5E-09	6.9E-12	1.5E+01	1.0E-10	100.00%
						SUMMARY CANCER RISK	1E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.87	NA		7.5E-09	1.9E-09	ND		
Iron	8080	NA		6.1E-06	1.6E-06	ND		
Manganese	231	NA		1.8E-07	4.5E-08	1.4E-05	3.2E-03	100.00%
VPH								
C9-C12 Aliphatics	0.57	NA		4.3E-10	1.1E-10	5.7E+00	2.0E-11	0.000001%
C9-C10 Aromatics	0.41	NA		3.1E-10	8.0E-11	1.7E-01	4.7E-10	
EPH								
C9-C18 Aliphatics	8.2	NA		6.2E-09	1.6E-09	5.7E+00	2.8E-10	
C19-C36 Aliphatics	101	NA		7.7E-08	2.0E-08	ND		
C11-C22 Aromatics	31	NA		2.3E-08	6.1E-09	2.0E-01	3.0E-08	0.001%
						SUMMARY HAZARD INDEX	0.003	

RES-SS2I

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

August 1992

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.08	mg/cm^2
SURFACE AREA EXPOSED	SA	5,800	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined   NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	4.2E-06	0.03	5.9E-07	1.5E+00	1.6E+00	6.3E-06	9.4E-07	7.3E-06	100.00%
					SUMMARY CANCER RISK		6E-06	9E-07	7E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	1.2E-05	0.03	1.7E-06	3.0E-04	2.9E-04	4.1E-02	5.9E-03	4.7E-02	37.90%
Chromium	27	1.6E-05	ND		3.0E-03	ND	5.3E-03		5.3E-03	4.26%
Iron	16,400	9.6E-03	ND		ND	ND				
Manganese	481	2.8E-04	ND		7.1E-02	ND	4.0E-03		4.0E-03	3.21%
VPH										
C9-C12 Aliphatics	32	1.9E-05	0.17	1.5E-05	6.0E-01	5.5E-01	3.1E-05	2.7E-05	5.8E-05	0.05%
C9-C10 Aromatics	23	1.4E-05	0.17	1.1E-05	3.0E-02	2.7E-02	4.5E-04	3.9E-04	8.4E-04	0.68%
EPH										
C9-C18 Aliphatics	465	2.7E-04	0.17	2.2E-04	6.0E-01	5.5E-01	4.5E-04	3.9E-04	8.5E-04	0.68%
C19-C36 Aliphatics	5,680	3.3E-03	0.17	2.6E-03	6.0E+00	5.5E+00	5.6E-04	4.8E-04	1.0E-03	0.83%
C11-C22 Aromatics	1770	1.0E-03	0.17	8.2E-04	3.0E-02	2.7E-02	3.5E-02	3.0E-02	6.5E-02	52.39%
				SUMMARY HAZARD INDEX			0.09	0.04	0.1	

RES-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.63	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS21
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	1.6E-10	1.5E+01	2.4E-09	22.15%
Chromium	27	NA		2.0E-08	2.1E-10	4.1E+01	8.5E-09	77.85%
						SUMMARY CANCER RISK	1E-08	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	4.7E-10	ND		
Chromium	27	NA		2.0E-08	6.1E-10	2.9E-05	2.1E-05	2.63%
Iron	16,400	NA		1.2E-05	3.7E-07	ND		
Manganese	481	NA		3.6E-07	1.1E-08	1.4E-05	7.7E-04	97.11%
VPH								
C9-C12 Aliphatics	32	NA		2.4E-08	7.2E-10	5.7E-01	1.3E-09	0.00016%
C9-C10 Aromatics	23	NA		1.7E-08	5.2E-10	1.7E-02	3.0E-08	0.0038%
EPH								
C9-C18 Aliphatics	465	NA		3.5E-07	1.0E-08	5.7E-01	1.8E-08	0.0023%
C19-C36 Aliphatics	5680	NA		4.3E-06	1.3E-07	ND		
C11-C22 Aromatics	1,770	NA		1.3E-06	4.0E-08	2.0E-02	2.0E-06	0.25%
						SUMMARY HAZARD INDEX	0.001	

PAGES 3 + 4 ARE MISSING IN ORIGINAL DOCUMENT

RES-SS2I

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²
SURFACE AREA EXPOSED	SA	2,045	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	9.9E-06	0.03	3.0E-06	1.5E+00	1.60E+00	1.5E-05	4.8E-06	2.0E-05	100.00%
					SUMMARY CANCER RISK		1E-05	5E-06	2E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	1.2E-04	0.03	3.5E-05	3.0E-04	2.9E-04	3.8E-01	1.2E-01	5.1E-01	31.98%
Chromium	27	1.5E-04	ND		3.0E-03	ND	4.9E-02		4.9E-02	3.12%
Iron	16,400	9.0E-02	ND		ND	ND				
Manganese	481	2.6E-03	ND		7.1E-02	ND	3.7E-02		3.7E-02	2.35%
VPH										
C9-C12 Aliphatics	32	1.8E-04	0.17	3.0E-04	6.0E-01	5.5E-01	2.9E-04	5.5E-04	8.5E-04	0.05%
C9-C10 Aromatics	23	1.3E-04	0.17	2.2E-04	3.0E-02	2.7E-02	4.2E-03	8.1E-03	1.2E-02	0.78%
EPH										
C9-C18 Aliphatics	465	2.5E-03	0.17	4.4E-03	6.0E-01	5.5E-01	4.2E-03	8.1E-03	1.2E-02	0.78%
C19-C36 Aliphatics	5,680	3.1E-02	0.17	5.4E-02	6.0E+00	5.5E+00	5.2E-03	9.8E-03	1.5E-02	0.95%
C11-C22 Aromatics	1770	9.7E-03	0.17	1.7E-02	3.0E-02	2.7E-02	3.2E-01	6.2E-01	9.5E-01	59.98%
				SUMMARY HAZARD INDEX			0.8	0.8	2	

RES-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.31	$m^3/hour$
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

INTAKE - INHALATION = $\frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CARCINOGENIC EFFECTS

RES-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	9.3E-11	1.5E+01	1.4E-09	22.15%
Chromium	27	NA		2.0E-08	1.2E-10	4.1E+01	4.9E-09	77.85%
						SUMMARY CANCER RISK	6E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	1.1E-09	ND		
Chromium	27	NA		2.0E-08	1.4E-09	2.9E-05	4.8E-05	2.63%
Iron	16,400	NA		1.2E-05	8.4E-07	ND		
Manganese	481	NA		3.6E-07	2.5E-08	1.4E-05	1.8E-03	97.11%
VPH								
C9-C12 Aliphatics	32	NA		2.4E-08	1.6E-09	5.7E-01	2.9E-09	0.00016%
C9-C10 Aromatics	23	NA		1.7E-08	1.2E-09	1.7E-02	7.0E-08	0.0038%
EPH								
C9-C18 Aliphatics	465	NA		3.5E-07	2.4E-08	5.7E-01	4.2E-08	0.0023%
C19-C36 Aliphatics	5680	NA		4.3E-06	2.9E-07	ND		
C11-C22 Aromatics	1,770	NA		1.3E-06	9.1E-08	2.0E-02	4.6E-06	0.25%
						SUMMARY HAZARD INDEX	0.002	

RES-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

03-Feb-00

August 1992

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.08	mg/cm^2
SURFACE AREA EXPOSED	SA	5,800	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.87	2.0E-06	0.03	2.8E-07	1.5E+00	1.60E+00	3.0E-06	4.4E-07	3.4E-06	100.00%
					SUMMARY CANCER RISK		3E-06	4E-07	3E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.87	5.8E-06	0.03	8.1E-07	3.0E-04	2.9E-04	1.9E-02	2.8E-03	2.2E-02	87.70%
Iron	8080	4.7E-03	ND		ND	ND				
Manganese	231	1.4E-04	ND		7.1E-02	4.3E-03	1.9E-03	0.0E+00	1.9E-03	7.58%
VPH										
C9-C12 Aliphatics	0.57	3.3E-07	0.17	2.6E-07	6.0E-01	5.5E-01	5.6E-07	4.8E-07	1.0E-06	0.004%
C9-C10 Aromatics	0.41	2.4E-07	0.17	1.9E-07	3.0E-02	2.7E-02	8.0E-06	7.0E-06	1.5E-05	0.06%
EPH										
C9-C18 Aliphatics	8.2	4.8E-06	0.17	3.8E-06	6.0E-01	5.5E-01	8.0E-06	6.9E-06	1.5E-05	0.06%
C19-C36 Aliphatics	101	5.9E-05	0.17	4.7E-05	6.0E+00	5.5E+00	9.9E-06	8.5E-06	1.8E-05	0.07%
C11-C22 Aromatics	31	1.8E-05	0.17	1.4E-05	3.0E-02	2.7E-02	6.1E-04	5.3E-04	1.1E-03	4.52%
					SUMMARY HAZARD INDEX		0.02	0.003	0.03	

RES-SB2I

INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME

UNRESTRICTED LAND USE - ADULT RESIDENT

AOC 57 AREA 2 INDUSTRIAL

FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.63	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration

**Volatilization factor used only for volatile chemicals of potential concern.

For noncarcinogenic effects: AT = ED

ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF

(VF not calculated because there are no VOCs selected as CPCs).

RES-SB2I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.87	NA		7.5E-09	7.6E-11	1.5E+01	1.1E-09	100.00%
						SUMMARY CANCER RISK	1E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.87	NA		7.5E-09	2.2E-10	ND		
Iron	8080	NA		6.1E-06	1.8E-07	ND		
Manganese	231	NA		1.8E-07	5.2E-09	1.4E-05	3.7E-04	99.99%
VPH								
C9-C12 Aliphatics	0.57	NA		4.3E-10	1.3E-11	5.7E-01	2.2E-11	0.000006%
C9-C10 Aromatics	0.41	NA		3.1E-10	9.2E-12	1.7E-02	5.4E-10	0.0001%
EPH								
C9-C18 Aliphatics	8.2	NA		6.2E-09	1.8E-10	5.7E-01	3.2E-10	0.00009%
C19-C36 Aliphatics	101	NA		7.7E-08	2.3E-09	ND		
C11-C22 Aromatics	31	NA		2.3E-08	6.9E-10	2.0E-02	3.5E-08	0.009%
						SUMMARY HAZARD INDEX	0.0004	

RES-SB2I

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME

UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)

AOC 57 AREA 2 INDUSTRIAL

FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	2,045	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:

For noncarcinogenic effects: AT = ED

The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.

*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.

ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.87	4.6E-06	0.03	1.4E-06	1.5E+00	1.60E+00	7.0E-06	2.3E-06	9.2E-06	100.00%
					SUMMARY CANCER RISK		7E-06	2E-06	9E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.87	5.4E-05	0.03	1.7E-05	3.0E-04	2.9E-04	1.8E-01	5.7E-02	2.4E-01	87.11%
Iron	8080	4.4E-02	ND		ND	ND				
Manganese	231	1.3E-03	ND		7.1E-02	4.3E-03	1.8E-02	0.0E+00	1.8E-02	6.54%
VPH										
C9-C12 Aliphatics	0.57	3.1E-06	0.17	5.4E-06	6.0E-01	5.5E-01	5.2E-06	9.9E-06	1.5E-05	0.006%
C9-C10 Aromatics	0.41	2.2E-06	0.17	3.9E-06	3.0E-02	2.7E-02	7.5E-05	1.4E-04	2.2E-04	0.08%
EPH										
C9-C18 Aliphatics	8.2	4.5E-05	0.17	7.8E-05	6.0E-01	5.5E-01	7.5E-05	1.4E-04	2.2E-04	0.08%
C19-C36 Aliphatics	101	5.5E-04	0.17	9.6E-04	6.0E+00	5.5E+00	9.2E-05	1.7E-04	2.7E-04	0.10%
C11-C22 Aromatics	31	1.7E-04	0.17	3.0E-04	3.0E-02	2.7E-02	5.7E-03	1.1E-02	1.7E-02	6.09%
				SUMMARY HAZARD INDEX			0.2	0.1	0.3	

RES-SB2I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.31	$m^3/hour$
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CARCINOGENIC EFFECTS

RES-SB2I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.87	NA		7.5E-09	4.4E-11	1.5E+01	6.5E-10	100.00%
						SUMMARY CANCER RISK	7E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.87	NA		7.5E-09	5.1E-10	ND		
Iron	8080	NA		6.1E-06	4.2E-07	ND		
Manganese	231	NA		1.8E-07	1.2E-08	1.4E-05	8.5E-04	99.99%
VPH								
C9-C12 Aliphatics	0.57	NA		4.3E-10	2.9E-11	5.7E-01	5.1E-11	0.000006%
C9-C10 Aromatics	0.41	NA		3.1E-10	2.1E-11	1.7E-02	1.2E-09	0.0001%
EPH								
C9-C18 Aliphatics	8.2	NA		6.2E-09	4.2E-10	5.7E-01	7.4E-10	0.00009%
C19-C36 Aliphatics	101	NA		7.7E-08	5.2E-09	ND		
C11-C22 Aromatics	31	NA		2.3E-08	1.6E-09	2.0E-02	8.0E-08	0.009%
						SUMMARY HAZARD INDEX	0.001	

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	chemical-specific	ug/liter
INGESTION RATE	IR	2	liters/day
BODY WEIGHT	BW	70	kg
CONVERSION FACTOR	CF	0.001	mg/ug
EXPOSURE FREQUENCY	EF	350	days/year
EXPOSURE DURATION	ED	30	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	30	years

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
No Carcinogenic CPCs					
			TOTAL CANCER RISK		0E+00

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Aluminum	204	ug/Liter	5.6E-03	1.0E+00	5.6E-03
Manganese	177	ug/Liter	4.8E-03	2.4E-02	2.0E-01
			TOTAL HAZARD INDEX		0.2

RECCH-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	3,850	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	38	kg
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RECCH-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	47.9	2.8E-06	0.03	3.3E-06	1.5E+00	1.60E+00	4.2E-06	5.2E-06	9.4E-06	74.22%
Aroclor-1260	3.6	2.1E-07	0.14	1.1E-06	2.0E+00	2.50E+00	4.2E-07	2.9E-06	3.3E-06	25.78%
					SUMMARY CANCER RISK		5E-06	8E-06	1E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	47.9	1.8E-05	0.03	2.1E-05	3.0E-04	2.9E-04	6.0E-02	7.2E-02	1.3E-01	16.91%
Iron	7920	3.0E-03	ND		ND	ND				
Manganese	273	1.0E-04	ND		7.1E-02	ND	1.4E-03		1.4E-03	0.19%
Aroclor-1260	3.6	1.3E-06	0.14	7.3E-06	2.0E-05	1.6E-05	6.7E-02	4.5E-01	5.2E-01	67.20%
VPH										
C9-C12 Aliphatics	21	7.9E-06	0.17	5.2E-05	6.0E-01	5.5E-01	1.3E-05	9.4E-05	1.1E-04	0.01%
C9-C10 Aromatics	17	6.4E-06	0.17	4.2E-05	3.0E-02	2.7E-02	2.1E-04	1.5E-03	1.8E-03	0.23%
EPH										
C9-C18 Aliphatics	298	1.1E-04	0.17	7.3E-04	6.0E-01	5.5E-01	1.9E-04	1.3E-03	1.5E-03	0.20%
C19-C36 Aliphatics	3640	1.4E-03	0.17	8.9E-03	6.0E+00	5.5E+00	2.3E-04	1.6E-03	1.9E-03	0.24%
C11-C22 Aromatics	1,130	4.2E-04	0.17	2.8E-03	3.0E-02	2.7E-02	1.4E-02	1.0E-01	1.2E-01	15.03%
				SUMMARY HAZARD INDEX			0.1	0.6	0.8	

RECCH-SD2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SEDIMENT	CS	See Below*	mg/kg
INGESTION RATE	IR	25	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²
SURFACE AREA EXPOSED	SA	3,850	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	38	kg
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RECCH-SD2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SEDIMENT CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	220	3.2E-06	0.03	1.5E-05	1.5E+00	1.6E+00	4.9E-06	2.4E-05	2.9E-05	99.96%
Lead	410	6.0E-06	ND	0.0E+00	ND	ND				0.00%
Dieldrin	0.046	6.8E-10	ND	0.0E+00	1.6E+01	ND	1.1E-08		1.1E-08	0.038%
SUMMARY CANCER RISK							5E-06	2E-05	3E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SEDIMENT CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	15,900	1.5E-03	ND		1.0E+00	ND	1.5E-03		1.5E-03	0.21%
Arsenic	220	2.1E-05	0.03	9.5E-05	3.0E-04	2.9E-04	6.9E-02	3.3E-01	4.0E-01	56.36%
Chromium	49	4.6E-06	ND		3.0E-03	7.5E-05	1.5E-03	0.0E+00	1.5E-03	0.22%
Iron	30400	2.8E-03	ND		ND	ND				
Lead	410	3.8E-05	ND		ND	ND				
Manganese	3940	3.7E-04	ND		7.1E-02	4.3E-03	5.2E-03	0.0E+00	5.2E-03	0.74%
Dieldrin	0.046	4.3E-09	ND		5.0E-05	ND	8.6E-05		8.6E-05	0.012%
Total Petroleum Hydrocarbons	3200	3.0E-04	0.17	7.9E-03	3.0E-02	2.7E-02	1.0E-02	2.9E-01	3.0E-01	42.68%
SUMMARY HAZARD INDEX							0.1	0.6	0.7	

RECCH-SW2R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA
EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	average	mg/liter
INGESTION RATE	IR	0.013	liters/hour
SURFACE AREA EXPOSED	SA	2,518	cm^2/day
CONVERSION FACTOR	CF	0.001	liter/cm^3
BODY WEIGHT	BW	38	kg
EXPOSURE TIME	ET	2	hours/day
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
PERMEABILITY COEFFICIENT	Kpevent	Chemical-specific	cm/day

Notes:
For noncarcinogenic effects: AT = ED
ND - Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CW \times Kpevent \times ET \times SA \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RECCH-SW2R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA
CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/L)	INTAKE INGESTION (mg/kg-day)	PERMEABILITY COEFFICIENT (cm/hour)	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL $(mg/kg\text{-}day)^{-1}$	CANCER SLOPE FACTOR DERMAL $(mg/kg\text{-}day)^{-1}$	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	0.198	3.0E-06	1.0E-03	5.9E-07	1.5E+00	1.6E+00	4.5E-06	9.4E-07	5.5E-06	99.86%
Lead	0.967	1.5E-05	1.0E-03	2.9E-06	NA	NA				
Bis(2-ethylhexyl)phthalate	0.024	3.7E-07	3.3E-02	2.3E-06	1.4E-02	NA	5.1E-09		5.1E-09	0.09%
Chloroform	0.00072	1.1E-08	1.3E-01	2.8E-07	6.1E-03	NA	6.7E-11		6.7E-11	0.0012%
Tetrachloroethylene	0.0026	4.0E-08	3.7E-01	2.9E-06	5.2E-02	NA	2.1E-09		2.1E-09	0.04%
Trichloroethylene	0.0035	5.4E-08	2.3E-01	2.4E-06	1.1E-02	NA	5.9E-10		5.9E-10	0.01%
					SUMMARY CANCER RISK		5E-06	9E-07	5E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/L)	INTAKE INGESTION (mg/kg-day)	PERMEABILITY COEFFICIENT (cm/hour)	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	15.1	1.5E-03	1.0E-03	2.9E-04	1.0E+00	NA	1.47E-03		1.5E-03	1.08%
Arsenic	0.198	1.9E-05	1.0E-03	3.7E-06	3.0E-04	2.9E-04	6.43E-02	1.29E-02	7.7E-02	56.45%
Barium	0.553	5.4E-05	1.0E-03	1.0E-05	7.0E-02	4.9E-03	7.70E-04	2.13E-03	2.9E-03	2.12%
Cadmium	0.025	2.4E-06	1.0E-03	4.7E-07	5.0E-04	2.5E-05	4.87E-03	1.89E-02	2.4E-02	17.36%
Chromium	0.036	3.5E-06	1.0E-03	6.8E-07	3.0E-03	7.5E-05	1.17E-03	9.06E-03	1.0E-02	7.48%
Copper	0.375	3.7E-05	1.0E-03	7.1E-06	NA	NA				
Iron	17.6	1.7E-03	1.0E-03	3.3E-04	NA	NA				
Lead	0.967	9.4E-05	1.0E-03	1.8E-05	NA	NA				
Manganese	0.433	4.2E-05	1.0E-03	8.2E-06	2.4E-02	1.4E-03	1.76E-03	5.84E-03	7.6E-03	5.55%
Vanadium	0.072	7.0E-06	1.0E-03	1.4E-06	7.0E-03	1.8E-04	1.00E-03	7.55E-03	8.6E-03	6.25%
Bis(2-ethylhexyl)phthalate	0.024	2.3E-06	3.3E-02	1.5E-05	2.0E-02	NA	1.17E-04		1.2E-04	0.086%
1,2-Dichloroethylenes	0.026	2.5E-06	1.0E-02	4.9E-06	9.0E-03	NA	2.82E-04		2.8E-04	0.21%
Chloroform	0.00072	7.0E-08	1.3E-01	1.8E-06	1.0E-02	NA	7.02E-06		7.0E-06	0.0051%
Tetrachloroethylene	0.0026	2.5E-07	3.7E-01	1.8E-05	1.0E-02	NA	2.53E-05		2.5E-05	0.019%
Trichloroethylene	0.0035	3.4E-07	2.3E-01	1.5E-05	6.0E-03	NA	5.69E-05		5.7E-05	0.042%
EPH Fractions										
C10-C22 Aromatics	1.4	1.4E-04	NA		3.0E-02	2.7E-02	4.55E-03		4.5E-03	3.33%
C19-C36 Aliphatics	1.7	1.7E-04	NA		6.0E+00	5.5E+00	2.76E-05		2.8E-05	0.020%
					SUMMARY HAZARD INDEX		0.1	0.06	0.1	

RECCH-SS2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	50	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	3,850	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	38	kg
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RECCH-SS2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	47.9	7.1E-07	0.03	1.6E-06	1.5E+00	1.60E+00	1.1E-06	2.6E-06	3.7E-06	70.48%
Aroclor-1260	3.6	5.3E-08	0.14	5.7E-07	2.0E+00	2.50E+00	1.1E-07	1.4E-06	1.5E-06	29.52%
					SUMMARY CANCER RISK		1E-06	4E-06	5E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	47.9	4.5E-06	0.03	1.0E-05	3.0E-04	2.9E-04	1.5E-02	3.6E-02	5.1E-02	14.39%
Iron	7920	7.4E-04	ND		ND	ND				
Manganese	273	2.6E-05	ND		7.1E-02	ND	3.6E-04		3.6E-04	0.10%
Aroclor-1260	3.6	3.4E-07	0.14	3.6E-06	2.0E-05	1.6E-05	1.7E-02	2.3E-01	2.4E-01	69.25%
VPH										
C9-C12 Aliphatics	21	2.0E-06	0.17	2.6E-05	6.0E-01	5.5E-01	3.3E-06	4.7E-05	5.0E-05	0.01%
C9-C10 Aromatics	17	1.6E-06	0.17	2.1E-05	3.0E-02	2.7E-02	5.3E-05	7.7E-04	8.3E-04	0.23%
EPH										
C9-C18 Aliphatics	298	2.8E-05	0.17	3.7E-04	6.0E-01	5.5E-01	4.7E-05	6.6E-04	7.1E-04	0.20%
C19-C36 Aliphatics	3640	3.4E-04	0.17	4.5E-03	6.0E+00	5.5E+00	5.7E-05	8.1E-04	8.7E-04	0.25%
C11-C22 Aromatics	1,130	1.1E-04	0.17	1.4E-03	3.0E-02	2.7E-02	3.5E-03	5.1E-02	5.5E-02	15.56%
					SUMMARY HAZARD INDEX		0.04	0.3	0.4	

RE CH-SD2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SEDIMENT	CS	See Below*	mg/kg
INGESTION RATE	IR	25	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	3,850	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	38	kg
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RECCH-SD2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SEDIMENT CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	220	1.6E-06	0.03	7.5E-06	1.5E+00	1.6E+00	2.4E-06	1.2E-05	1.4E-05	99.96%
Lead	410	3.0E-06	ND	0.0E+00	ND	ND				0.00%
Dieldrin	0.046	3.4E-10	ND	0.0E+00	1.6E+01	ND	5.4E-09		5.4E-09	0.038%
					SUMMARY CANCER RISK		2E-06	1E-05	1E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SEDIMENT CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	15,900	7.5E-04	ND		1.0E+00	ND	7.5E-04		7.5E-04	0.21%
Arsenic	220	1.0E-05	0.03	4.8E-05	3.0E-04	2.9E-04	3.4E-02	1.6E-01	2.0E-01	56.36%
Chromium	49	2.3E-06	ND		3.0E-03	7.5E-05	7.7E-04	0.0E+00	7.7E-04	0.22%
Iron	30400	1.4E-03	ND		ND	ND				
Lead	410	1.9E-05	ND		ND	ND				
Manganese	3940	1.8E-04	ND		7.1E-02	4.3E-03	2.6E-03	0.0E+00	2.6E-03	0.74%
Dieldrin	0.046	2.2E-09	ND		5.0E-05	ND	4.3E-05		4.3E-05	0.012%
Total Petroleum Hydrocarbons	3200	1.5E-04	0.17	3.9E-03	3.0E-02	2.7E-02	5.0E-03	1.5E-01	1.5E-01	42.68%
				SUMMARY HAZARD INDEX			0.04	0.3	0.4	

RECCH-SW2R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - CT
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA
EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	average	mg/liter
INGESTION RATE	IR	0.013	liters/hour
SURFACE AREA EXPOSED	SA	2,518	cm^2/day
CONVERSION FACTOR	CF	0.001	liter/cm^3
BODY WEIGHT	BW	38	kg
EXPOSURE TIME	ET	2	hours/day
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
PERMEABILITY COEFFICIENT	Kpevent	Chemical-specific	cm/day

Notes:
For noncarcinogenic effects: AT = ED
ND - Value not determined
TPHC - Total Petroleum Hydrocarbons

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

INTAKE-INGESTION = $\frac{CW \times IR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

INTAKE-DERMAL = $\frac{CW \times Kpevent \times ET \times SA \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

RECCH-SW2R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - CT
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA
CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/L)	INTAKE INGESTION (mg/kg-day)	PERMEABILITY COEFFICIENT (cm/hour)	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)^-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)^-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	0.198	1.5E-06	1.0E-03	2.9E-07	1.5E+00	1.6E+00	2.3E-06	4.7E-07	2.7E-06	99.86%
Lead	0.967	7.4E-06	1.0E-03	1.4E-06	NA	NA				
Bis(2-ethylhexyl)phthalate	0.024	1.8E-07	3.3E-02	1.2E-06	1.4E-02	NA	2.6E-09		2.6E-09	0.09%
Chloroform	0.00072	5.5E-09	1.3E-01	1.4E-07	6.1E-03	NA	3.4E-11		3.4E-11	0.0012%
Tetrachloroethylene	0.0026	2.0E-08	3.7E-01	1.4E-06	5.2E-02	NA	1.0E-09		1.0E-09	0.04%
Trichloroethylene	0.0035	2.7E-08	2.3E-01	1.2E-06	1.1E-02	NA	2.9E-10		2.9E-10	0.01%
					SUMMARY CANCER RISK		2E-06	5E-07	3E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/L)	INTAKE INGESTION (mg/kg-day)	PERMEABILITY COEFFICIENT (cm/hour)	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	15.1	7.4E-04	1.0E-03	1.4E-04	1.0E+00	NA	7.36E-04		7.4E-04	1.08%
Arsenic	0.198	9.7E-06	1.0E-03	1.9E-06	3.0E-04	2.9E-04	3.22E-02	6.45E-03	3.9E-02	56.45%
Barium	0.553	2.7E-05	1.0E-03	5.2E-06	7.0E-02	4.9E-03	3.85E-04	1.07E-03	1.5E-03	2.12%
Cadmium	0.025	1.2E-06	1.0E-03	2.4E-07	5.0E-04	2.5E-05	2.44E-03	9.44E-03	1.2E-02	17.36%
Chromium	0.036	1.8E-06	1.0E-03	3.4E-07	3.0E-03	7.5E-05	5.85E-04	4.53E-03	5.1E-03	7.48%
Copper	0.375	1.8E-05	1.0E-03	3.5E-06	NA	NA				
Iron	17.6	8.6E-04	1.0E-03	1.7E-04	NA	NA				
Lead	0.967	4.7E-05	1.0E-03	9.1E-06	NA	NA				
Manganese	0.433	2.1E-05	1.0E-03	4.1E-06	2.4E-02	1.4E-03	8.79E-04	2.92E-03	3.8E-03	5.55%
Vanadium	0.072	3.5E-06	1.0E-03	6.8E-07	7.0E-03	1.8E-04	5.01E-04	3.78E-03	4.3E-03	6.25%
Bis(2-ethylhexyl)phthalate	0.024	1.2E-06	3.3E-02	7.5E-06	2.0E-02	NA	5.85E-05		5.8E-05	0.086%
1,2-Dichloroethylenes	0.026	1.3E-06	1.0E-02	2.5E-06	9.0E-03	NA	1.41E-04		1.4E-04	0.21%
Chloroform	0.00072	3.5E-08	1.3E-01	8.8E-07	1.0E-02	NA	3.51E-06		3.5E-06	0.0051%
Tetrachloroethylene	0.0026	1.3E-07	3.7E-01	9.1E-06	1.0E-02	NA	1.27E-05		1.3E-05	0.019%
Trichloroethylene	0.0035	1.7E-07	2.3E-01	7.6E-06	6.0E-03	NA	2.84E-05		2.8E-05	0.042%
EPH Fractions										
C10-C22 Aromatics	1.4	6.8E-05	NA		3.0E-02	2.7E-02	2.27E-03		2.3E-03	3.33%
C19-C36 Aliphatics	1.7	8.3E-05	NA		6.0E+00	5.5E+00	1.38E-05		1.4E-05	0.020%
					SUMMARY HAZARD INDEX		0.04	0.03	0.07	

CON-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.5	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

CON-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	47.9	1.6E-06	0.03	1.5E-07	1.5E+00	1.60E+00	2.4E-06	2.3E-07	2.6E-06	87.73%
Aroclor-1260	3.6	1.2E-07	0.14	5.1E-08	2.0E+00	2.50E+00	2.4E-07	1.3E-07	3.7E-07	12.27%
					SUMMARY CANCER RISK		3E-06	4E-07	3E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	47.9	2.2E-04	0.03	2.0E-05	3.0E-04	2.9E-04	7.5E-01	7.1E-02	8.2E-01	59.23%
Iron	7,920	3.7E-02	ND	0.0E+00	ND	ND				
Manganese	273	1.3E-03	ND	0.0E+00	7.1E-02	4.30E-03	1.8E-02	0.0E+00	1.8E-02	1.30%
Aroclor-1260	3.6	1.7E-05	0.14	7.2E-06	5.0E-05	4.0E-05	3.4E-01	1.8E-01	5.2E-01	37.37%
VPH										
C9-C12 Aliphatics	21	9.9E-05	0.17	5.1E-05	6.0E+00	5.5E+00	1.6E-05	9.2E-06	2.6E-05	0.002%
C9-C10 Aromatics	17	8.0E-05	0.17	4.1E-05	3.0E-01	2.7E-01	2.7E-04	1.5E-04	4.2E-04	0.03%
EPH										
C9-C18 Aliphatics	298	1.4E-03	0.17	7.2E-04	6.0E+00	5.5E+00	2.3E-04	1.3E-04	3.6E-04	0.03%
C19-C36 Aliphatics	3640	1.7E-02	0.17	8.8E-03	6.0E+01	5.5E+01	2.8E-04	1.6E-04	4.5E-04	0.03%
C11-C22 Aromatics	1,130	5.3E-03	0.17	2.7E-03	3.0E-01	2.7E-01	1.8E-02	1.0E-02	2.8E-02	2.01%
					SUMMARY HAZARD INDEX		1	0.3	1	

CON-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.50	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	47.9	NA		3.6E-08	6.7E-11	1.5E+01	1.0E-09	99.01%
Aroclor-1260	3.6	NA		2.7E-09	5.0E-12	2.0E+00	1.0E-11	0.99%
						SUMMARY CANCER RISK	1E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	47.9	NA		3.6E-08	9.4E-09	ND		
Iron	7,920	NA		6.0E-06	1.5E-06	ND		
Manganese	273	NA		2.1E-07	5.3E-08	1.4E-05	3.8E-03	99.97%
Aroclor-1260	3.6	NA		2.7E-09	7.0E-10	ND		
VPH								
C9-C12 Aliphatics	21	NA		1.6E-08	4.1E-09	5.7E+00	7.2E-10	0.0000189%
C9-C10 Aromatics	17	NA		1.3E-08	3.3E-09	1.7E-01	2.0E-08	0.000513%
EPH								
C9-C18 Aliphatics	298	NA		2.3E-07	5.8E-08	5.7E+00	1.0E-08	0.000268%
C19-C36 Aliphatics	3640	NA		2.8E-06	7.1E-07	ND		
C11-C22 Aromatics	1,130	NA		8.6E-07	2.2E-07	2.0E-01	1.1E-06	0.0290%
						SUMMARY HAZARD INDEX	0.00	

CON-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.5	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

CON-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	7.0E-07	0.03	6.4E-08	1.5E+00	1.60E+00	1.1E-06	1.0E-07	1.2E-06	47.37%
Lead	5060	1.7E-04	ND	0.0E+00	ND	ND				
Dieldrin	0.0113	3.8E-10	ND	0.0E+00	1.6E+01	ND	6.1E-09		6.1E-09	0.25%
Aroclor- 1248	0.482	1.6E-08	0.14	6.9E-09	2.0E+00	2.50E+00	3.2E-08	1.7E-08	5.0E-08	2.02%
Aroclor-1260	12	4.0E-07	0.14	1.7E-07	2.0E+00	2.50E+00	8.1E-07	4.3E-07	1.2E-06	50.36%
					SUMMARY CANCER RISK		2E-06	5E-07	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	3.3E-02	ND	0.0E+00	1.0E+00	ND	3.3E-02		3.3E-02	
Arsenic	21	9.9E-05	0.03	9.0E-06	3.0E-04	2.9E-04	3.3E-01	3.1E-02	3.6E-01	12.21%
Chromium	2410	1.1E-02	ND	0.0E+00	2.0E-02	5.0E-04	5.7E-01	0.0E+00	5.7E-01	19.21%
Iron	6880	3.2E-02	ND	0.0E+00	ND	ND				
Lead	5060	2.4E-02	ND	0.0E+00	ND	ND				
Manganese	169	7.9E-04	ND	0.0E+00	7.1E-02	4.3E-03	1.1E-02	0.0E+00	1.1E-02	0.38%
Dieldrin	0.0113	5.3E-08	ND	0.0E+00	5.0E-05	ND	1.1E-03		1.1E-03	0.04%
Aroclor-1248	0.482	2.3E-06	0.14	9.6E-07	5.0E-05	4.0E-05	4.5E-02	2.4E-02	6.9E-02	2.35%
Aroclor-1260	12	5.6E-05	0.14	2.4E-05	5.0E-05	4.0E-05	1.1E+00	6.0E-01	1.7E+00	58.56%
VPH										
C9-C12 Aliphatics	130	6.1E-04	0.17	3.1E-04	6.0E+00	5.5E+00	1.0E-04	5.7E-05	1.6E-04	0.005%
C9-C10 Aromatics	93	4.4E-04	0.17	2.3E-04	3.0E-01	2.7E-01	1.5E-03	8.3E-04	2.3E-03	0.08%
EPH										
C9-C18 Aliphatics	1860	8.7E-03	0.17	4.5E-03	6.0E+00	5.5E+00	1.5E-03	8.2E-04	2.3E-03	0.08%
C19-C36 Aliphatics	22,700	1.1E-01	0.17	5.5E-02	6.0E+01	5.5E+01	1.8E-03	1.0E-03	2.8E-03	0.09%
C11-C22 Aromatics	7050	3.3E-02	0.17	1.7E-02	3.0E-01	2.7E-01	1.1E-01	6.3E-02	1.7E-01	5.89%
				SUMMARY HAZARD INDEX			2	0.7	3	

CON-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.50	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(\text{CAp} + \text{Cav}) \times \text{RAF} \times \text{IhR} \times \text{ET} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT} \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	2.9E-11	1.5E+01	4.4E-10	0.32%
Chromium	2410	NA		1.8E-06	3.4E-09	4.1E+01	1.4E-07	99.66%
Lead	5060	NA		3.8E-06	7.1E-09	ND		
Dieldrin	0.0113	NA		8.6E-12	1.6E-14	1.6E+01	2.5E-13	0.00018%
Aroclor- 1248	0.482	NA		3.7E-10	6.7E-13	2.0E+00	1.3E-12	0.00097%
Aroclor-1260	12	NA		9.1E-09	1.7E-11	2.0E+00	3.4E-11	0.024%
						SUMMARY CANCER RISK	1E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	NA		5.3E-06	1.4E-06	1.0E-03	1.4E-03	6.82%
Arsenic	21	NA		1.6E-08	4.1E-09	ND		
Chromium	2410	NA		1.8E-06	4.7E-07	2.9E-05	1.6E-02	81.33%
Iron	6880	NA		5.2E-06	1.3E-06	ND		
Lead	5060	NA		3.8E-06	9.9E-07	ND		
Manganese	169	NA		1.3E-07	3.3E-08	1.4E-05	2.4E-03	11.81%
Dieldrin	0.0113	NA		8.6E-12	2.2E-12	ND		
Aroclor-1248	0.482	NA		3.7E-10	9.4E-11	ND		
Aroclor-1260	12	NA		9.1E-09	2.3E-09	ND		
VPH		NA						
C9-C12 Aliphatics	130	NA		9.8E-08	2.5E-08	5.7E+00	4.5E-09	0.000022%
C9-C10 Aromatics	93	NA		7.0E-08	1.8E-08	1.7E-01	1.1E-07	0.00054%
EPH		NA						
C9-C18 Aliphatics	1860	NA		1.4E-06	3.6E-07	5.7E+00	6.4E-08	0.00032%
C19-C36 Aliphatics	22,700	NA		1.7E-05	4.4E-06	ND		
C11-C22 Aromatics	7050	NA		5.3E-06	1.4E-06	2.0E-01	6.9E-06	0.034%
						SUMMARY HAZARD INDEX	0.02	

CON-SS2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

CON-SS2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR		CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
					ORAL (mg/kg-day)-1	DERMAL (mg/kg-day)-1				
Arsenic	47.9	8.0E-07	0.03	7.3E-08	1.5E+00	1.60E+00	1.2E-06	1.2E-07	1.3E-06	87.73%
Aroclor-1260	3.6	6.0E-08	0.14	2.6E-08	2.0E+00	2.50E+00	1.2E-07	6.4E-08	1.8E-07	12.27%
SUMMARY CANCER RISK							1E-06	2E-07	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE		HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
					ORAL (mg/kg-day)	DERMAL (mg/kg-day)				
Arsenic	47.9	2.2E-04	0.03	2.0E-05	3.0E-04	2.9E-04	7.5E-01	7.1E-02	8.2E-01	59.23%
Iron	7,920	3.7E-02	ND		ND	ND				
Manganese	273	1.3E-03	ND		7.1E-02	4.30E-03	1.8E-02	0.0E+00	1.8E-02	1.30%
Aroclor-1260	3.6	1.7E-05	0.14	7.2E-06	5.0E-05	4.0E-05	3.4E-01	1.8E-01	5.2E-01	37.37%
VPH										
C9-C12 Aliphatics	21	9.9E-05	0.17	5.1E-05	6.0E+00	5.5E+00	1.6E-05	9.2E-06	2.6E-05	0.002%
C9-C10 Aromatics	17	8.0E-05	0.17	4.1E-05	3.0E-01	2.7E-01	2.7E-04	1.5E-04	4.2E-04	0.03%
EPH										
C9-C18 Aliphatics	298	1.4E-03	0.17	7.2E-04	6.0E+00	5.5E+00	2.3E-04	1.3E-04	3.6E-04	0.03%
C19-C36 Aliphatics	3640	1.7E-02	0.17	8.8E-03	6.0E+01	5.5E+01	2.8E-04	1.6E-04	4.5E-04	0.03%
C11-C22 Aromatics	1,130	5.3E-03	0.17	2.7E-03	3.0E-01	2.7E-01	1.8E-02	1.0E-02	2.8E-02	2.01%
SUMMARY HAZARD INDEX							1	0.3	1	

CON-SS2R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	m^3/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

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Rev. 8/92

CON-SS2R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	47.9	NA		3.6E-08	3.3E-11	1.5E+01	5.0E-10	99.01%
Aroclor-1260	3.6	NA		2.7E-09	2.5E-12	2.0E+00	5.0E-12	0.99%
						SUMMARY CANCER RISK	5E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	47.9	NA		3.6E-08	9.4E-09	ND		
Iron	7,920	NA		6.0E-06	1.5E-06	ND		
Manganese	273	NA		2.1E-07	5.3E-08	1.4E-05	3.8E-03	99.97%
Aroclor-1260	3.6	NA		2.7E-09	7.0E-10	ND		
VPH								
C9-C12 Aliphatics	21	NA		1.6E-08	4.1E-09	5.7E+00	7.2E-10	0.00002%
C9-C10 Aromatics	17	NA		1.3E-08	3.3E-09	1.7E-01	2.0E-08	0.0005%
EPH								
C9-C18 Aliphatics	298	NA		2.3E-07	5.8E-08	5.7E+00	1.0E-08	0.0003%
C19-C36 Aliphatics	3640	NA		2.8E-06	7.1E-07	ND		
C11-C22 Aromatics	1,130	NA		8.6E-07	2.2E-07	2.0E-01	1.1E-06	0.03%
						SUMMARY HAZARD INDEX	0.004	

CON-SB2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm²
SURFACE AREA	SA	5200	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	3.5E-07	0.03	3.2E-08	1.5E+00	1.60E+00	5.3E-07	5.1E-08	5.8E-07	47.37%
Lead	5060	8.5E-05	ND	0.0E+00	ND	ND				
Dieldrin	0.0113	1.9E-10	ND	0.0E+00	1.6E+01	ND	3.0E-09		3.0E-09	0.25%
Aroclor- 1248	0.482	8.1E-09	0.14	3.4E-09	2.0E+00	2.50E+00	1.6E-08	8.6E-09	2.5E-08	2.02%
Aroclor-1260	12	2.0E-07	0.14	8.5E-08	2.0E+00	2.50E+00	4.0E-07	2.1E-07	6.2E-07	50.36%
SUMMARY CANCER RISK							1E-06	3E-07	1E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	3.3E-02	ND	0.0E+00	ND	ND				
Arsenic	21	9.9E-05	0.03	9.0E-06	3.0E-04	2.9E-04	3.3E-01	3.1E-02	3.6E-01	12.34%
Chromium	2410	1.1E-02	ND	0.0E+00	2.0E-02	5.0E-04	5.7E-01	0.0E+00	5.7E-01	19.42%
Iron	6880	3.2E-02	ND	0.0E+00	ND	ND				
Lead	5060	2.4E-02	ND	0.0E+00	ND	ND				
Manganese	169	7.9E-04	ND	0.0E+00	7.1E-02	4.30E-03	1.1E-02	0.0E+00	1.1E-02	0.38%
Dieldrin	0.0113	5.3E-08	ND	0.0E+00	5.0E-05	ND	1.1E-03		1.1E-03	0.04%
Aroclor-1248	0.482	2.3E-06	0.14	9.6E-07	5.0E-05	4.0E-05	4.5E-02	2.4E-02	6.9E-02	2.38%
Aroclor-1260	12	5.6E-05	0.14	2.4E-05	5.0E-05	4.0E-05	1.1E+00	6.0E-01	1.7E+00	59.22%
VPH										
C9-C12 Aliphatics	130	6.1E-04	0.17	3.1E-04	6.0E+00	5.5E+00	1.0E-04	5.7E-05	1.6E-04	0.005%
C9-C10 Aromatics	93	4.4E-04	0.17	2.3E-04	3.0E-01	2.7E-01	1.5E-03	8.3E-04	2.3E-03	0.08%
EPH										
C9-C18 Aliphatics	1860	8.7E-03	0.17	4.5E-03	6.0E+00	5.5E+00	1.5E-03	8.2E-04	2.3E-03	0.08%
C19-C36 Aliphatics	22,700	1.1E-01	0.17	5.5E-02	6.0E+01	5.5E+01	1.8E-03	1.0E-03	2.8E-03	0.10%
C11-C22 Aromatics	7050	3.3E-02	0.17	1.7E-02	3.0E-01	2.7E-01	1.1E-01	6.3E-02	1.7E-01	5.96%
SUMMARY HAZARD INDEX							2	0.7	3	

CON-SBI(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	m^3/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB2R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	1.5E-11	1.5E+01	2.2E-10	0.32%
Chromium	2410	NA		1.8E-06	1.7E-09	4.1E+01	6.9E-08	99.66%
Lead	5060	NA		3.8E-06	3.5E-09	ND		
Dieldrin	0.0113	NA		8.6E-12	7.9E-15	1.6E+01	1.3E-13	0.00018%
Aroclor- 1248	0.482	NA		3.7E-10	3.4E-13	2.0E+00	6.7E-13	0.00097%
Aroclor-1260	12	NA		9.1E-09	8.4E-12	2.0E+00	1.7E-11	0.024%
						SUMMARY CANCER RISK	7E-08	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	NA		5.3E-06	1.4E-06	1.0E-03	1.4E-03	7.32%
Arsenic	21	NA		1.6E-08	4.1E-09	ND		
Chromium	2410	NA		1.8E-06	4.7E-07	2.9E-05	1.6E-02	87.28%
Iron	6880	NA		5.2E-06	1.3E-06	ND		
Lead	5060	NA		3.8E-06	9.9E-07	ND		
Manganese	169	NA		1.3E-07	3.3E-08	1.4E-05	2.4E-03	12.68%
Dieldrin	0.0113	NA		8.6E-12	2.2E-12	ND		
Aroclor-1248	0.482	NA		3.7E-10	9.4E-11	ND		
Aroclor-1260	12	NA		9.1E-09	2.3E-09	ND		
VPH		NA						
C9-C12 Aliphatics	130	NA		9.8E-08	2.5E-08	5.7E+00	4.5E-09	0.000024%
C9-C10 Aromatics	93	NA		7.0E-08	1.8E-08	1.7E-01	1.1E-07	0.00057%
EPH		NA						
C9-C18 Aliphatics	1860	NA		1.4E-06	3.6E-07	5.7E+00	6.4E-08	0.00034%
C19-C36 Aliphatics	22,700	NA		1.7E-05	4.4E-06	ND		
C11-C22 Aromatics	7050	NA		5.3E-06	1.4E-06	2.0E-01	6.9E-06	0.037%
						SUMMARY HAZARD INDEX	0.02	

RES-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.08	mg/cm²
SURFACE AREA EXPOSED	SA	5,800	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	47.9	9.6E-06	0.03	1.3E-06	1.5E+00	1.6E+00	1.4E-05	2.1E-06	1.7E-05	86.35%
Aroclor-1260	3.6	7.2E-07	0.14	4.7E-07	2.0E+00	2.5E+00	1.4E-06	1.2E-06	2.6E-06	13.65%
					SUMMARY CANCER RISK		2E-05	3E-06	2E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	47.9	2.8E-05	0.03	3.9E-06	3.0E-04	2.9E-04	9.4E-02	1.3E-02	1.1E-01	31.14%
Iron	7920	4.6E-03	ND		ND	ND				
Manganese	273	1.6E-04	ND		7.1E-02	ND	2.3E-03		2.3E-03	0.66%
Aroclor-1260	3.6	2.1E-06	0.14	1.4E-06	2.0E-05	1.6E-05	1.1E-01	8.6E-02	1.9E-01	55.61%
VPH										
C9-C12 Aliphatics	21	1.2E-05	0.17	9.7E-06	6.0E-01	5.5E-01	2.1E-05	1.8E-05	3.8E-05	0.01%
C9-C10 Aromatics	17	1.0E-05	0.17	7.9E-06	3.0E-02	2.7E-02	3.3E-04	2.9E-04	6.2E-04	0.18%
EPH										
C9-C18 Aliphatics	298	1.7E-04	0.17	1.4E-04	6.0E-01	5.5E-01	2.9E-04	2.5E-04	5.4E-04	0.16%
C19-C36 Aliphatics	3,640	2.1E-03	0.17	1.7E-03	6.0E+00	5.5E+00	3.6E-04	3.1E-04	6.6E-04	0.19%
C11-C22 Aromatics	1130	6.6E-04	0.17	5.2E-04	3.0E-02	2.7E-02	2.2E-02	1.9E-02	4.1E-02	12.05%
				SUMMARY HAZARD INDEX			0.2	0.1	0.3	

RES-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.63	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	47.9	NA		3.6E-08	3.7E-10	1.5E+01	5.5E-09	99.01%
Aroclor-1260	3.6	NA		2.7E-09	2.8E-11	2.0E+00	5.5E-11	0.99%
						SUMMARY CANCER RISK	6E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	47.9	NA		3.6E-08	1.1E-09	ND		
Iron	7920	NA		6.0E-06	1.8E-07	ND		
Manganese	273	NA		2.1E-07	6.1E-09	1.4E-05	4.4E-04	99.70%
Aroclor-1260	3.6	NA		2.7E-09	8.1E-11	ND		
VPH								
C9-C12 Aliphatics	21	NA		1.6E-08	4.7E-10	5.7E-01	8.3E-10	0.00019%
C9-C10 Aromatics	17	NA		1.3E-08	3.8E-10	1.7E-02	2.2E-08	0.0051%
EPH								
C9-C18 Aliphatics	298	NA		2.3E-07	6.7E-09	5.7E-01	1.2E-08	0.0027%
C19-C36 Aliphatics	3,640	NA		2.8E-06	8.2E-08	ND		
C11-C22 Aromatics	1130	NA		8.6E-07	2.5E-08	2.0E-02	1.3E-06	0.29%
						SUMMARY HAZARD INDEX	0.0004	

RES-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	2,045	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	47.9	2.2E-05	0.03	6.9E-06	1.5E+00	1.6E+00	3.4E-05	1.1E-05	4.5E-05	82.60%
Aroclor-1260	3.6	1.7E-06	0.14	2.4E-06	2.0E+00	2.5E+00	3.4E-06	6.1E-06	9.4E-06	17.40%
					SUMMARY CANCER RISK		4E-05	2E-05	5E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	47.9	2.6E-04	0.03	8.05E-05	3.0E-04	2.9E-04	8.7E-01	2.8E-01	1.2E+00	25.29%
Iron	7920	4.3E-02	ND		ND	ND				
Manganese	273	1.5E-03	ND		7.1E-02	ND	2.1E-02		2.1E-02	0.46%
Aroclor-1260	3.6	2.0E-05	0.14	2.8E-05	2.0E-05	1.6E-05	9.9E-01	1.8E+00	2.8E+00	60.37%
VPH										
C9-C12 Aliphatics	21	1.2E-04	0.17	2.0E-04	6.0E-01	5.5E-01	1.9E-04	3.6E-04	5.6E-04	0.01%
C9-C10 Aromatics	17	9.3E-05	0.17	1.6E-04	3.0E-02	2.7E-02	3.1E-03	6.0E-03	9.1E-03	0.20%
EPH										
C9-C18 Aliphatics	298	1.6E-03	0.17	2.8E-03	6.0E-01	5.5E-01	2.7E-03	5.2E-03	7.9E-03	0.17%
C19-C36 Aliphatics	3,640	2.0E-02	0.17	3.5E-02	6.0E+00	5.5E+00	3.3E-03	6.3E-03	9.6E-03	0.21%
C11-C22 Aromatics	1130	6.2E-03	0.17	1.1E-02	3.0E-02	2.7E-02	2.1E-01	4.0E-01	6.1E-01	13.28%
				SUMMARY HAZARD INDEX			2	2	5	

RES-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m³
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m³
VOLATILIZATION FACTOR**	VF	Calculated	m³/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m³
INHALATION RATE	IhR	0.31	m³/hour
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	47.9	NA		3.6E-08	2.1E-10	1.5E+01	3.2E-09	99.01%
Aroclor-1260	3.6	NA		2.7E-09	1.6E-11	2.0E+00	3.2E-11	0.99%
					SUMMARY CANCER RISK		3E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	47.9	NA		3.6E-08	2.5E-09	ND		
Iron	7920	NA		6.0E-06	4.1E-07	ND		
Manganese	273	NA		2.1E-07	1.4E-08	1.4E-05	1.0E-03	99.70%
Aroclor-1260	3.6	NA		2.7E-09	1.9E-10	ND		
VPH								
C9-C12 Aliphatics	21	NA		1.6E-08	1.1E-09	5.7E-01	1.9E-09	0.00019%
C9-C10 Aromatics	17	NA		1.3E-08	8.8E-10	1.7E-02	5.1E-08	0.0051%
EPH								
C9-C18 Aliphatics	298	NA		2.3E-07	1.5E-08	5.7E-01	2.7E-08	0.0027%
C19-C36 Aliphatics	3,640	NA		2.8E-06	1.9E-07	ND		
C11-C22 Aromatics	1130	NA		8.6E-07	5.8E-08	2.0E-02	2.9E-06	0.29%
					SUMMARY HAZARD INDEX		0.001	

RES-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.08	mg/cm^2
SURFACE AREA EXPOSED	SA	5,800	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	4.2E-06	0.03	5.9E-07	1.5E+00	1.60E+00	6.3E-06	9.4E-07	7.3E-06	44.34%
Lead	5060	1.0E-03	ND		ND	ND				
Dieldrin	0.0113	2.3E-09	ND		1.6E+01	ND	3.6E-08		3.6E-08	0.22%
Aroclor-1248	0.482	9.7E-08	0.14	6.3E-08	2.0E+00	2.50E+00	1.9E-07	1.6E-07	3.5E-07	2.14%
Aroclor-1260	12	2.4E-06	0.14	1.6E-06	2.0E+00	2.50E+00	4.8E-06	3.9E-06	8.8E-06	53.30%
					SUMMARY CANCER RISK		1E-05	5E-06	2E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	4.1E-03	ND		ND	ND				
Arsenic	21	1.2E-05	0.03	1.7E-06	3.0E-04	2.9E-04	4.1E-02	5.9E-03	4.7E-02	3.23%
Chromium	2410	1.4E-03	ND		3.0E-03	7.5E-05	4.7E-01	0.0E+00	4.7E-01	32.43%
Iron	6880	4.0E-03	ND		ND	ND				
Lead	5060	3.0E-03	ND		ND	ND				
Manganese	169	9.9E-05	ND		7.1E-02	4.3E-03	1.4E-03	0.0E+00	1.4E-03	0.10%
Dieldrin	0.0113	6.6E-09	ND		5.0E-05	ND	1.3E-04		1.3E-04	0.01%
Aroclor-1248	0.482	2.8E-07	0.14	1.8E-07	2.0E-05	1.6E-05	1.4E-02	1.1E-02	2.6E-02	1.76%
Aroclor-1260	12	7.0E-06	0.14	4.6E-06	2.0E-05	1.6E-05	3.5E-01	2.9E-01	6.4E-01	43.89%
VPH										
C9-C12 Aliphatics	130	7.6E-05	0.17	6.0E-05	6.0E-01	5.5E-01	1.3E-04	1.1E-04	2.4E-04	0.02%
C9-C10 Aromatics	93	5.5E-05	0.17	4.3E-05	3.0E-02	2.7E-02	1.8E-03	1.6E-03	3.4E-03	0.23%
EPH										
C9-C18 Aliphatics	1860	1.1E-03	0.17	8.6E-04	6.0E-01	5.5E-01	1.8E-03	1.6E-03	3.4E-03	0.23%
C19-C36 Aliphatics	22700	1.3E-02	0.17	1.1E-02	6.0E+00	5.5E+00	2.2E-03	1.9E-03	4.1E-03	0.28%
C11-C22 Aromatics	7050	4.1E-03	0.17	3.3E-03	3.0E-02	2.7E-02	1.4E-01	1.2E-01	2.6E-01	17.80%
					SUMMARY HAZARD INDEX		1.0	0.4	1.5	

RES-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.63	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	NA		1.6E-08	1.6E-10	1.5E+01	2.4E-09	0.32%
Chromium	2410	NA		1.8E-06	1.9E-08	4.1E+01	7.6E-07	99.66%
Lead	5060	NA		3.8E-06	3.9E-08	ND		
Dieldrin	0.0113	NA		8.6E-12	8.7E-14	1.6E+01	1.4E-12	0.0002%
Aroclor-1248	0.482	NA		3.7E-10	3.7E-12	2.0E+00	7.4E-12	0.001%
Aroclor-1260	12	NA		9.1E-09	9.2E-11	2.0E+00	1.8E-10	0.02%
						SUMMARY CANCER RISK	8E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	NA		5.3E-06	1.6E-07	1.0E-03	1.6E-04	6.80%
Arsenic	21	NA		1.6E-08	4.7E-10	ND		
Chromium	2410	NA		1.8E-06	5.4E-08	2.9E-05	1.9E-03	81.07%
Iron	6880	NA		5.2E-06	1.5E-07	ND		
Lead	5060	NA		3.8E-06	1.1E-07	ND		
Manganese	169	NA		1.3E-07	3.8E-09	1.4E-05	2.7E-04	
Dieldrin	0.0113	NA		8.6E-12	2.5E-13	ND		
Aroclor-1248	0.482	NA		3.7E-10	1.1E-11	ND		
Aroclor-1260	12	NA		9.1E-09	2.7E-10	ND		
VPH		NA						
C9-C12 Aliphatics	130	NA		9.8E-08	2.9E-09	5.7E-01	5.1E-09	0.0002%
C9-C10 Aromatics	93	NA		7.0E-08	2.1E-09	1.7E-02	1.2E-07	0.005%
EPH		NA						
C9-C18 Aliphatics	1860	NA		1.4E-06	4.2E-08	5.7E-01	7.3E-08	0.003%
C19-C36 Aliphatics	22,700	NA		1.7E-05	5.1E-07	ND		
C11-C22 Aromatics	7050	NA		5.3E-06	1.6E-07	2.0E-02	7.9E-06	0.34%
						SUMMARY HAZARD INDEX	0.0023	

RES-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	2,045	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	21	9.9E-06	0.03	3.0E-06	1.5E+00	1.60E+00	1.5E-05	4.8E-06	2.0E-05	37.45%
Lead	5060	2.4E-03	ND		ND	ND				
Dieldrin	0.0113	5.3E-09	ND		1.6E+01	ND	8.5E-08		8.5E-08	0.16%
Aroclor-1248	0.482	2.3E-07	0.14	3.2E-07	2.0E+00	2.50E+00	4.5E-07	8.1E-07	1.3E-06	2.41%
Aroclor-1260	12	5.6E-06	0.14	8.1E-06	2.0E+00	2.50E+00	1.1E-05	2.0E-05	3.1E-05	59.97%
SUMMARY CANCER RISK							3E-05	3E-05	5E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Aluminum	6970	3.8E-02	ND		ND	ND				
Arsenic	21	1.2E-04	0.03	3.5E-05	3.0E-04	2.9E-04	3.8E-01	1.2E-01	5.1E-01	2.75%
Chromium	2410	1.3E-02	ND		3.0E-03	7.5E-05	4.4E+00	0.0E+00	4.4E+00	23.93%
Iron	6880	3.8E-02	ND		ND	ND				
Lead	5060	2.8E-02	ND		ND	ND				
Manganese	169	9.3E-04	ND		7.1E-02	4.3E-03	1.3E-02	0.0E+00	1.3E-02	0.07%
Dieldrin	0.0113	6.2E-08	ND		5.0E-05	ND	1.2E-03		1.2E-03	0.01%
Aroclor-1248	0.482	2.6E-06	0.14	3.8E-06	2.0E-05	1.6E-05	1.3E-01	2.4E-01	3.7E-01	2.00%
Aroclor-1260	12	6.6E-05	0.14	9.4E-05	2.0E-05	1.6E-05	3.3E+00	5.9E+00	9.2E+00	49.85%
VPH										
C9-C12 Aliphatics	130	7.1E-04	0.17	1.2E-03	6.0E-01	5.5E-01	1.2E-03	2.3E-03	3.4E-03	0.02%
C9-C10 Aromatics	93	5.1E-04	0.17	8.9E-04	3.0E-02	2.7E-02	1.7E-02	3.3E-02	5.0E-02	0.27%
EPH										
C9-C18 Aliphatics	1860	1.0E-02	0.17	1.8E-02	6.0E-01	5.5E-01	1.7E-02	3.2E-02	4.9E-02	0.27%
C19-C36 Aliphatics	22700	1.2E-01	0.17	2.2E-01	6.0E+00	5.5E+00	2.1E-02	3.9E-02	6.0E-02	0.33%
C11-C22 Aromatics	7050	3.9E-02	0.17	6.7E-02	3.0E-02	2.7E-02	1.3E+00	2.5E+00	3.8E+00	20.52%
SUMMARY HAZARD INDEX							10	9	18	

RES-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.31	$m^3/hour$
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION		INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
			VOLATILES (mg/m^3)	PARTICULATES (mg/m^3)				
Arsenic	21	NA		1.6E-08	9.3E-11	1.5E+01	1.4E-09	0.32%
Chromium	2410	NA		1.8E-06	1.1E-08	4.1E+01	4.4E-07	99.66%
Lead	5060	NA		3.8E-06	2.2E-08	ND		
Dieldrin	0.0113	NA		8.6E-12	5.0E-14	1.6E+01	8.0E-13	0.0002%
Aroclor-1248	0.482	NA		3.7E-10	2.1E-12	2.0E+00	4.3E-12	0.001%
Aroclor-1260	12	NA		9.1E-09	5.3E-11	2.0E+00	1.1E-10	0.024%
						SUMMARY CANCER RISK	4E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION		INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
			VOLATILES (mg/m^3)	PARTICULATES (mg/m^3)				
Aluminum	6970	NA		5.3E-06	3.6E-07	1.0E-03	3.6E-04	6.80%
Arsenic	21	NA		1.6E-08	1.1E-09	ND		
Chromium	2410	NA		1.8E-06	1.2E-07	2.9E-05	4.3E-03	81.07%
Iron	6880	NA		5.2E-06	3.5E-07	ND		
Lead	5060	NA		3.8E-06	2.6E-07	ND		
Manganese	169	NA		1.3E-07	8.7E-09	1.4E-05	6.2E-04	11.78%
Dieldrin	0.0113	NA		8.6E-12	5.8E-13	ND		
Aroclor-1248	0.482	NA		3.7E-10	2.5E-11	ND		
Aroclor-1260	12	NA		9.1E-09	6.2E-10	ND		
VPH		NA						
C9-C12 Aliphatics	130	NA		9.8E-08	6.7E-09	5.7E-01	1.2E-08	
C9-C10 Aromatics	93	NA		7.0E-08	4.8E-09	1.7E-02	2.8E-07	0.005%
EPH		NA						
C9-C18 Aliphatics	1860	NA		1.4E-06	9.6E-08	5.7E-01	1.7E-07	0.003%
C19-C36 Aliphatics	22,700	NA		1.7E-05	1.2E-06	ND		
C11-C22 Aromatics	7050	NA		5.3E-06	3.6E-07	2.0E-02	1.8E-05	0.34%
						SUMMARY HAZARD INDEX	0.005	

RES-GW21
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	chemical-specific	ug/liter
INGESTION RATE	IR	2	liters/day
BODY WEIGHT	BW	70	kg
CONVERSION FACTOR	CF	0.001	mg/ug
EXPOSURE FREQUENCY	EF	350	days/year
EXPOSURE DURATION	ED	30	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	30	years

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

RES-GW21
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
Arsenic	54.4	ug/Liter	6.4E-04	1.5E+00	9.6E-04
Aroclor-1260	0.22	ug/Liter	2.6E-06	2.0E+00	5.2E-06
Bis(2-ethylhexyl)phthalate	400	ug/Liter	4.7E-03	1.4E-02	6.6E-05
Tetrachloroethylene	16	ug/Liter	1.9E-04	5.2E-02	9.8E-06
Trikchloroethylene	1.9	ug/Liter	2.2E-05	1.1E-02	2.5E-07
			TOTAL CANCER RISK		1E-03

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Arsenic	54.4	ug/Liter	1.5E-03	3.0E-04	5.0E+00
Iron	3610	ug/Liter	9.9E-02	ND	
Manganese	724	ug/Liter	2.0E-02	2.4E-02	8.3E-01
Aroclor-1260	0.22	ug/Liter	6.0E-06	2.0E-05	3.0E-01
Bis(2-ethylhexyl)phthalate	400	ug/Liter	1.1E-02	2.0E-02	5.5E-01
1,2-Dichloroethylene	13	ug/Liter	3.6E-04	9.0E-03	4.0E-02
Tetrachloroethylene	16	ug/Liter	4.4E-04	1.0E-02	4.4E-02
Trichloroethylene	1.9	ug/Liter	5.2E-05	6.0E-03	8.7E-03
			TOTAL HAZARD INDEX		7

MAIN-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.024	mg/cm^2
SURFACE AREA EXPOSED	SA	11,600	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
The exposure frequency is assumed to be 1 day a week from May 1st to October 31st.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

MAIN-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	3.0E-06	0.03	2.5E-07	1.5E+00	1.6E+00	4.5E-06	4.0E-07	4.9E-06	100.00%
					SUMMARY CANCER RISK		4E-06	4E-07	5E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	8.3E-06	0.03	7.0E-07	3.0E-04	2.9E-04	2.8E-02	2.4E-03	3.0E-02	94.57%
Iron	8040	1.6E-03	ND		ND	ND				
Manganese	548	1.1E-04	ND		7.1E-02	ND	1.6E-03		1.6E-03	4.92%
VPH										
C9-C12 Aliphatics	16	3.3E-06	0.17	1.5E-06	6.0E-01	5.5E-01	5.4E-06	2.8E-06	8.2E-06	0.03%
C9-C10 Aromatics	4.85	9.9E-07	0.17	4.7E-07	3.0E-02	2.7E-02	3.3E-05	1.7E-05	5.0E-05	0.16%
EPH										
C9-C18 Aliphatics	3.63	7.4E-07	0.17	3.5E-07	6.0E-01	5.5E-01	1.2E-06	6.4E-07	1.9E-06	0.006%
C19-C36 Aliphatics	38	7.7E-06	0.17	3.7E-06	6.0E+00	5.5E+00	1.3E-06	6.7E-07	2.0E-06	0.006%
C11-C22 Aromatics	10	2.0E-06	0.17	9.4E-07	3.0E-02	2.7E-02	6.6E-05	3.5E-05	1.0E-04	0.32%
				SUMMARY HAZARD INDEX			0.03	0.002	0.03	

MAIN-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	1.6	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

MAIN-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	2.9E-10	1.5E+01	4.3E-09	100.00%
						SUMMARY CANCER RISK	4E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	8.1E-10	ND		
Iron	8040	NA		6.1E-06	1.6E-07	ND		
Manganese	548	NA		4.2E-07	1.1E-08	1.4E-05	7.7E-04	100.00%
VPH								
C9-C12 Aliphatics	16	NA		1.2E-08	3.2E-10	5.7E-01	5.5E-10	0.00000072
C9-C10 Aromatics	4.85	NA		3.7E-09	9.6E-11	1.7E-02	5.6E-09	0.0000073
EPH								
C9-C18 Aliphatics	3.6	NA		2.8E-09	7.2E-11	5.7E-01	1.3E-10	0.00000016
C19-C36 Aliphatics	38	NA		2.9E-08	7.5E-10	ND		
C11-C22 Aromatics	10	NA		7.4E-09	1.9E-10	2.0E-02	9.6E-09	0.000012
						SUMMARY HAZARD INDEX	0.0008	

MAIN-SS3I(CT)

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY

FUTURE/CURRENT MAINTENANCE WORKER

AOC 57 AREA 3 INDUSTRIAL

FORT DEVENS, MA

14-Mar-00

August 1992

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	50	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.024	mg/cm²
SURFACE AREA EXPOSED	SA	11,600	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	6.6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
The exposure frequency is assumed to be 1 day a week from May 1st to October 31st.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

MAIN-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	2.0E-07	0.03	3.3E-08	1.5E+00	1.6E+00	3.0E-07	5.3E-08	3.5E-07	100.00%
					SUMMARY CANCER RISK		3E-07	5E-08	3E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	2.1E-06	0.03	3.5E-07	3.0E-04	2.9E-04	7.0E-03	1.2E-03	8.2E-03	94.80%
Iron	8040	4.1E-04	ND		ND	ND				
Manganese	548	2.8E-05	ND		7.1E-02	ND	3.9E-04		3.9E-04	4.56%
VPH										
C9-C12 Aliphatics	16	8.1E-07	0.17	7.7E-07	6.0E-01	5.5E-01	1.4E-06	1.4E-06	2.8E-06	0.03%
C9-C10 Aromatics	4.85	2.5E-07	0.17	2.3E-07	3.0E-02	2.7E-02	8.2E-06	8.7E-06	1.7E-05	0.20%
EPH										
C9-C18 Aliphatics	3.63	1.8E-07	0.17	1.7E-07	6.0E-01	5.5E-01	3.1E-07	3.2E-07	6.3E-07	0.007%
C19-C36 Aliphatics	38	1.9E-06	0.17	1.8E-06	6.0E+00	5.5E+00	3.2E-07	3.3E-07	6.5E-07	0.008%
C11-C22 Aromatics	10	5.0E-07	0.17	4.7E-07	3.0E-02	2.7E-02	1.7E-05	1.7E-05	3.4E-05	0.39%
				SUMMARY HAZARD INDEX			0.007	0.0012	0.009	

MAIN-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	1.6	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	6.6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

INTAKE - INHALATION = $\frac{(CAp + CAv) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

MAIN-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$	CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	3.8E-11	1.5E+01	5.7E-10	100.00%
						SUMMARY CANCER RISK	6E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	4.0E-10	ND		
Iron	8040	NA		6.1E-06	7.9E-08	ND		
Manganese	548	NA		4.2E-07	5.4E-09	1.4E-05	3.9E-04	100.00%
VPH								
C9-C12 Aliphatics	16	NA		1.2E-08	1.6E-10	5.7E-01	2.8E-10	0.00000072
C9-C10 Aromatics	4.85	NA		3.7E-09	4.8E-11	1.7E-02	2.8E-09	0.0000073
EPH								
C9-C18 Aliphatics	3.6	NA		2.8E-09	3.6E-11	5.7E-01	6.3E-11	0.00000016
C19-C36 Aliphatics	38	NA		2.9E-08	3.7E-10	ND		
C11-C22 Aromatics	10	NA		7.4E-09	9.6E-11	2.0E-02	4.8E-09	0.000012
						SUMMARY HAZARD INDEX	0.0004	

CWIW-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

August 1992

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.016	mg/cm^2
SURFACE AREA EXPOSED	SA	12,731	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

CWIW-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	8.6E-06	0.03	5.3E-07	1.5E+00	1.6E+00	1.3E-05	8.4E-07	1.4E-05	100.00%
					SUMMARY CANCER RISK		1E-05	8E-07	1E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	2.4E-05	0.03	1.5E-06	3.0E-04	2.9E-04	8.0E-02	5.1E-03	8.5E-02	94.51%
Iron	8040	4.7E-03	ND		ND	ND				
Manganese	548	3.2E-04	ND		7.1E-02	ND	4.5E-03		4.5E-03	5.02%
VPH										
C9-C12 Aliphatics	16	9.4E-06	0.17	3.3E-06	6.0E-01	5.5E-01	1.6E-05	5.9E-06	2.2E-05	0.02%
C9-C10 Aromatics	4.85	2.8E-06	0.17	9.9E-07	3.0E-02	2.7E-02	9.5E-05	3.7E-05	1.3E-04	0.15%
EPH										
C9-C18 Aliphatics	3.63	2.1E-06	0.17	7.4E-07	6.0E-01	5.5E-01	3.6E-06	1.3E-06	4.9E-06	0.01%
C19-C36 Aliphatics	38	2.2E-05	0.17	7.7E-06	6.0E+00	5.5E+00	3.7E-06	1.4E-06	5.1E-06	0.01%
C11-C22 Aromatics	10	5.7E-06	0.17	2.0E-06	3.0E-02	2.7E-02	1.9E-04	7.3E-05	2.6E-04	0.29%
				SUMMARY HAZARD INDEX			0.09	0.005	0.09	

CWIW-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	1.6	m^3/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CWIW-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	8.3E-10	1.5E+01	1.3E-08	100.00%
						SUMMARY CANCER RISK	1E-08	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	2.3E-09	ND		
Iron	8040	NA		6.1E-06	4.6E-07	ND		
Manganese	548	NA		4.2E-07	3.1E-08	1.4E-05	2.2E-03	100.00%
VPH								
C9-C12 Aliphatics	16	NA		1.2E-08	9.1E-10	5.7E-01	1.6E-09	0.00000072
C9-C10 Aromatics	4.85	NA		3.7E-09	2.8E-10	1.7E-02	1.6E-08	0.0000073
EPH								
C9-C18 Aliphatics	3.6	NA		2.8E-09	2.1E-10	5.7E-01	3.6E-10	0.00000016
C19-C36 Aliphatics	38	NA		2.9E-08	2.2E-09	ND		
C11-C22 Aromatics	10	NA		7.4E-09	5.6E-10	2.0E-02	2.8E-08	0.000012
						SUMMARY HAZARD INDEX	0.002	

CWIW-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	50	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.016	mg/cm²
SURFACE AREA EXPOSED	SA	12,731	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6.6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CWIW-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	1.1E-06	0.03	1.4E-07	1.5E+00	1.6E+00	1.7E-06	2.2E-07	1.9E-06	100.00%
					SUMMARY CANCER RISK		2E-06	2E-07	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	1.2E-05	0.03	1.5E-06	3.0E-04	2.9E-04	4.0E-02	5.1E-03	4.5E-02	94.68%
Iron	8040	2.4E-03	ND		ND	ND				
Manganese	548	1.6E-04	ND		7.1E-02	ND	2.3E-03		2.3E-03	4.75%
VPH										
C9-C12 Aliphatics	16	4.7E-06	0.17	3.3E-06	6.0E-01	5.5E-01	7.8E-06	5.9E-06	1.4E-05	0.03%
C9-C10 Aromatics	4.85	1.4E-06	0.17	9.9E-07	3.0E-02	2.7E-02	4.7E-05	3.7E-05	8.4E-05	0.18%
EPH										
C9-C18 Aliphatics	3.63	1.1E-06	0.17	7.4E-07	6.0E-01	5.5E-01	1.8E-06	1.3E-06	3.1E-06	0.01%
C19-C36 Aliphatics	38	1.1E-05	0.17	7.7E-06	6.0E+00	5.5E+00	1.9E-06	1.4E-06	3.3E-06	0.01%
C11-C22 Aromatics	10	2.9E-06	0.17	2.0E-06	3.0E-02	2.7E-02	9.5E-05	7.3E-05	1.7E-04	0.35%
				SUMMARY HAZARD INDEX			0.04	0.005	0.05	

CWIW-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	1.6	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6.6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CWIW-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	2.2E-10	1.5E+01	3.3E-09	100.00%
						SUMMARY CANCER RISK	3E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	2.3E-09	ND		
Iron	8040	NA		6.1E-06	4.6E-07	ND		
Manganese	548	NA		4.2E-07	3.1E-08	1.4E-05	2.2E-03	100.00%
VPH								
C9-C12 Aliphatics	16	NA		1.2E-08	9.1E-10	5.7E-01	1.6E-09	0.00000072
C9-C10 Aromatics	4.85	NA		3.7E-09	2.8E-10	1.7E-02	1.6E-08	0.0000073
EPH								
C9-C18 Aliphatics	3.6	NA		2.8E-09	2.1E-10	5.7E-01	3.6E-10	0.00000016
C19-C36 Aliphatics	38	NA		2.9E-08	2.2E-09	ND		
C11-C22 Aromatics	10	NA		7.4E-09	5.6E-10	2.0E-02	2.8E-08	0.000012
						SUMMARY HAZARD INDEX	0.002	

CWIW-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	chemical-specific	ug/liter
INGESTION RATE	IR	1	liters/day
BODY WEIGHT	BW	70	kg
CONVERSION FACTOR	CF	0.001	mg/ug
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	25	years

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{CW \times IR \times EF \times ED \times CF}{BW \times AT \times 365 \text{ days/year}}$$

CWIW-GW21
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
Arsenic	33.2	ug/Liter	1.2E-04	1.5E+00	1.7E-04
Cadmium	8.67	ug/Liter	3.0E-05	ND	
1,4-Dichlorobenzene	5.6	ug/Liter	2.0E-05	2.4E-02	4.7E-07
Naphthalene	20	ug/Liter	7.0E-05	ND	
Carbon Tetrachloride	4.5	ug/Liter	1.6E-05	1.3E-01	2.0E-06
Chlorofoem	10	ug/Liter	3.5E-05	6.1E-03	2.1E-07
Tetrachloroethene	2.6	ug/Liter	9.1E-06	5.2E-02	4.7E-07
			TOTAL CANCER RISK		2E-04

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Aluminum	190	ug/Liter	1.9E-03	1.0E+00	1.9E-03
Arsenic	33.2	ug/Liter	3.2E-04	3.0E-04	1.1E+00
Cadmium	8.67	ug/Liter	8.5E-05	5.0E-04	1.7E-01
Iron	12400	ug/Liter	1.2E-01	ND	
Manganese	466	ug/Liter	4.6E-03	2.4E-02	1.9E-01
1,2-Dichlorobenzene	9.8	ug/Liter	9.6E-05	9.0E-02	1.1E-03
1,4-Dichlorobenzene	5.6	ug/Liter	5.5E-05	3.0E-02	1.8E-03
Naphthalene	20	ug/Liter	2.0E-04	2.0E-02	9.8E-03
Carbon Tetrachloride	4.5	ug/Liter	4.4E-05	7.0E-04	6.3E-02
Chloroform	10	ug/Liter	9.8E-05	1.0E-02	9.8E-03
Tetrachloroethene	2.6	ug/Liter	2.5E-05	1.0E-02	2.5E-03
C9-C10 Aromatics	310	ug/Liter	3.0E-03	3.0E-02	1.0E-01
			TOTAL HAZARD INDEX		2

CWIW-GW2I(CT)
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - CENTRAL TENDENCY
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	chemical-specific	ug/liter
INGESTION RATE	IR	1	liters/day
BODY WEIGHT	BW	70	kg
CONVERSION FACTOR	CF	0.001	mg/ug
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	6.6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6.6	years

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

CWIW-GW2I(CT)
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - CENTRAL TENDENCY
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
Arsenic	33.2	ug/Liter	3.1E-05	1.5E+00	4.6E-05
Cadmium	8.67	ug/Liter	8.0E-06	ND	
1,4-Dichlorobenzene	5.6	ug/Liter	5.2E-06	2.4E-02	1.2E-07
Naphthalene	20	ug/Liter	1.8E-05	ND	
Carbon Tetrachloride	4.5	ug/Liter	4.2E-06	1.3E-01	5.4E-07
Chlorofoem	10	ug/Liter	9.2E-06	6.1E-03	5.6E-08
Tetrachloroethene	2.6	ug/Liter	2.4E-06	5.2E-02	1.2E-07
			TOTAL CANCER RISK		5E-05

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Aluminum	190	ug/Liter	1.9E-03	1.0E+00	1.9E-03
Arsenic	33.2	ug/Liter	3.2E-04	3.0E-04	1.1E+00
Cadmium	8.67	ug/Liter	8.5E-05	5.0E-04	1.7E-01
Iron	12400	ug/Liter	1.2E-01	ND	
Manganese	466	ug/Liter	4.6E-03	2.4E-02	1.9E-01
1,2-Dichlorobenzene	9.8	ug/Liter	9.6E-05	9.0E-02	1.1E-03
1,4-Dichlorobenzene	5.6	ug/Liter	5.5E-05	3.0E-02	1.8E-03
Naphthalene	20	ug/Liter	2.0E-04	2.0E-02	9.8E-03
Carbon Tetrachloride	4.5	ug/Liter	4.4E-05	7.0E-04	6.3E-02
Chloroform	10	ug/Liter	9.8E-05	1.0E-02	9.8E-03
Tetrachloroethene	2.6	ug/Liter	2.5E-05	1.0E-02	2.5E-03
C9-C10 Aromatics	310	ug/Liter	3.0E-03	3.0E-02	1.0E-01
			TOTAL HAZARD INDEX		2

CON-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm²
SURFACE AREA	SA	5200	cm2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.5	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{\text{CS x IR x FI x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{\text{CS x SA x SAF x AE x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

CON-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	1.4E-06	0.03	1.3E-07	1.5E+00	1.60E+00	2.1E-06	2.0E-07	2.3E-06	100.00%
					SUMMARY CANCER RISK		2E-06	2E-07	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	1.9E-04	0.03	1.8E-05	3.0E-04	2.9E-04	6.4E-01	6.0E-02	7.0E-01	95.04%
Iron	8040	3.8E-02	ND	0.0E+00	ND	ND				
Manganese	548	2.6E-03	ND	0.0E+00	7.1E-02	4.30E-03	3.6E-02	0.0E+00	3.6E-02	4.91%
VPH										
C9-C12 Aliphatics	16	7.5E-05	0.17	3.9E-05	6.0E+00	5.5E+00	1.3E-05	7.0E-06	2.0E-05	0.003%
C9-C10 Aromatics	4.85	2.3E-05	0.17	1.2E-05	3.0E-01	2.7E-01	7.6E-05	4.4E-05	1.2E-04	0.02%
EPH										
C9-C18 Aliphatics	3.6	1.7E-05	0.17	8.8E-06	6.0E+00	5.5E+00	2.8E-06	1.6E-06	4.4E-06	0.001%
C19-C36 Aliphatics	38	1.8E-04	0.17	9.2E-05	6.0E+01	5.5E+01	3.0E-06	1.7E-06	4.6E-06	0.001%
C11-C22 Aromatics	10	4.6E-05	0.17	2.4E-05	3.0E-01	2.7E-01	1.5E-04	8.7E-05	2.4E-04	0.03%
				SUMMARY HAZARD INDEX			0.7	0.06	0.7	

CON-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	m^3/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.50	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	5.7E-11	1.5E+01	8.6E-10	100.00%
						SUMMARY CANCER RISK	9E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	8.0E-09	ND		
Iron	8040	NA		6.1E-06	1.6E-06	ND		
Manganese	548	NA		4.2E-07	1.1E-07	1.4E-05	7.7E-03	100.00%
<u>VPH</u>								
C9-C12 Aliphatics	16	NA		1.2E-08	3.1E-09	5.7E+00	5.5E-10	0.000000072
C9-C10 Aromatics	4.85	NA		3.7E-09	9.5E-10	1.7E-01	5.6E-09	0.00000073
<u>EPH</u>								
C9-C18 Aliphatics	3.6	NA		2.8E-09	7.1E-10	5.7E+00	1.2E-10	0.000000016
C19-C36 Aliphatics	38	NA		2.9E-08	7.4E-09	ND		
C11-C22 Aromatics	10	NA		7.4E-09	1.9E-09	2.0E-01	9.5E-09	0.0000012
						SUMMARY HAZARD INDEX	0.008	

CON-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.5	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR		CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
					ORAL (mg/kg-day)-1	DERMAL (mg/kg-day)-1				
Arsenic	9.67	3.2E-07	0.03	3.0E-08	1.5E+00	1.60E+00	4.9E-07	4.7E-08	5.3E-07	100.00%
SUMMARY CANCER RISK							5E-07	5E-08	5E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE		HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
					ORAL (mg/kg-day)	DERMAL (mg/kg-day)				
Arsenic	9.67	4.5E-05	0.03	4.1E-06	3.0E-04	2.9E-04	1.5E-01	1.4E-02	1.7E-01	98.26%
Iron	6410	3.0E-02	ND	0.0E+00	ND	ND				
VPH										
C9-C12 Aliphatics	0.84	3.9E-06	0.17	2.0E-06	6.0E+00	5.5E+00	6.6E-07	3.7E-07	1.0E-06	0.001%
C9-C10 Aromatics	0.35	1.6E-06	0.17	8.5E-07	3.0E-01	2.7E-01	5.5E-06	3.1E-06	8.6E-06	0.01%
EPH										
C9-C18 Aliphatics	78	3.7E-04	0.17	1.9E-04	6.0E+00	5.5E+00	6.1E-05	3.4E-05	9.5E-05	0.06%
C19-C36 Aliphatics	990	4.6E-03	0.17	2.4E-03	6.0E+01	5.5E+01	7.7E-05	4.4E-05	1.2E-04	0.07%
C11-C22 Aromatics	110	5.2E-04	0.17	2.7E-04	3.0E-01	2.7E-01	1.7E-03	9.9E-04	2.7E-03	1.61%
SUMMARY HAZARD INDEX							0.2	0.02	0.2	

CON-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.50	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.67	NA		7.3E-09	1.4E-11	1.5E+01	2.0E-10	100.00%
						SUMMARY CANCER RISK	2E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.67	NA		7.3E-09	1.9E-09	ND		
Iron	6410	NA		4.9E-06	1.3E-06	ND		
VPH								
C9-C12 Aliphatics	0.84	NA		6.4E-10	1.6E-10	5.7E+00	2.9E-11	0.026%
C9-C10 Aromatics	0.35	NA		2.7E-10	6.8E-11	1.7E-01	4.0E-10	0.36%
EPH								
C9-C18 Aliphatics	78	NA		5.9E-08	1.5E-08	5.7E+00	2.7E-09	2.42%
C19-C36 Aliphatics	990	NA		7.5E-07	1.9E-07	ND		
C11-C22 Aromatics	110	NA		8.3E-08	2.2E-08	2.0E-01	1.1E-07	97.19%
						SUMMARY HAZARD INDEX	0.0000001	

CON-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

INTAKE-INGESTION = $\dfrac{\text{CS x IR x FI x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$

INTAKE-DERMAL = $\dfrac{\text{CS x SA x SAF x AE x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$

CON-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	6.9E-07	0.03	6.3E-08	1.5E+00	1.60E+00	1.0E-06	1.0E-07	1.1E-06	100.00%
					SUMMARY CANCER RISK		1E-06	1E-07	1E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	1.9E-04	0.03	1.8E-05	3.0E-04	2.9E-04	6.4E-01	6.0E-02	7.0E-01	95.04%
Iron	8040	3.8E-02	ND	0.0E+00	ND	ND				
Manganese	548	2.6E-03	ND	0.0E+00	7.1E-02	4.30E-03	3.6E-02	0.0E+00	3.6E-02	4.91%
VPH										
C9-C12 Aliphatics	16	7.5E-05	0.17	3.9E-05	6.0E+00	5.5E+00	1.3E-05	7.0E-06	2.0E-05	0.003%
C9-C10 Aromatics	4.85	2.3E-05	0.17	1.2E-05	3.0E-01	2.7E-01	7.6E-05	4.4E-05	1.2E-04	0.02%
EPH										
C9-C18 Aliphatics	3.6	1.7E-05	0.17	8.8E-06	6.0E+00	5.5E+00	2.8E-06	1.6E-06	4.4E-06	0.001%
C19-C36 Aliphatics	38	1.8E-04	0.17	9.2E-05	6.0E+01	5.5E+01	3.0E-06	1.7E-06	4.6E-06	0.001%
C11-C22 Aromatics	10	4.6E-05	0.17	2.4E-05	3.0E-01	2.7E-01	1.5E-04	8.7E-05	2.4E-04	0.03%
				SUMMARY HAZARD INDEX			0.7	0.06	0.7	

CON-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	m^3/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	2.9E-11	1.5E+01	4.3E-10	100.00%
						SUMMARY CANCER RISK	4E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	8.0E-09	ND		
Iron	8040	NA		6.1E-06	1.6E-06	ND		
Manganese	548	NA		4.2E-07	1.1E-07	1.4E-05	7.7E-03	100.00%
VPH								
C9-C12 Aliphatics	16	NA		1.2E-08	3.1E-09	5.7E+00	5.5E-10	0.000000072
C9-C10 Aromatics	4.85	NA		3.7E-09	9.5E-10	1.7E-01	5.6E-09	0.00000073
EPH								
C9-C18 Aliphatics	3.6	NA		2.8E-09	7.1E-10	5.7E+00	1.2E-10	0.000000016
C19-C36 Aliphatics	38	NA		2.9E-08	7.4E-09	ND		
C11-C22 Aromatics	10	NA		7.4E-09	1.9E-09	2.0E-01	9.5E-09	0.0000012
						SUMMARY HAZARD INDEX	0.008	

CON-SB3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm²
SURFACE AREA	SA	5200	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{\text{CS x IR x FI x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{\text{CS x SA x SAF x AE x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

CON-SB3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR		CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
					ORAL (mg/kg-day)-1	DERMAL (mg/kg-day)-1				
Arsenic	9.67	1.6E-07	0.03	1.5E-08	1.5E+00	1.60E+00	2.4E-07	2.4E-08	2.7E-07	100.00%
SUMMARY CANCER RISK							2E-07	2E-08	3E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE		HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
					ORAL (mg/kg-day)	DERMAL (mg/kg-day)				
Arsenic	9.67	4.5E-05	0.03	4.1E-06	3.0E-04	2.9E-04	1.5E-01	1.4E-02	1.7E-01	98.26%
Iron	6410	3.0E-02	ND	0.0E+00	ND	ND				
VPH										
C9-C12 Aliphatics	0.84	3.9E-06	0.17	2.0E-06	6.0E+00	5.5E+00	6.6E-07	3.7E-07	1.0E-06	0.001%
C9-C10 Aromatics	0.35	1.6E-06	0.17	8.5E-07	3.0E-01	2.7E-01	5.5E-06	3.1E-06	8.6E-06	0.01%
EPH										
C9-C18 Aliphatics	78	3.7E-04	0.17	1.9E-04	6.0E+00	5.5E+00	6.1E-05	3.4E-05	9.5E-05	0.06%
C19-C36 Aliphatics	990	4.6E-03	0.17	2.4E-03	6.0E+01	5.5E+01	7.7E-05	4.4E-05	1.2E-04	0.07%
C11-C22 Aromatics	110	5.2E-04	0.17	2.7E-04	3.0E-01	2.7E-01	1.7E-03	9.9E-04	2.7E-03	1.61%
SUMMARY HAZARD INDEX							0.2	0.02	0.2	

CON-SB3i(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.67	NA		7.3E-09	6.8E-12	1.5E+01	1.0E-10	100.00%
						SUMMARY CANCER RISK	1E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.67	NA		7.3E-09	1.9E-09	ND		
Iron	6410	NA		4.9E-06	1.3E-06	ND		
VPH								
C9-C12 Aliphatics	0.84	NA		6.4E-10	1.6E-10	5.7E+00	2.9E-11	0.026%
C9-C10 Aromatics	0.35	NA		2.7E-10	6.8E-11	1.7E-01	4.0E-10	0.36%
EPH								
C9-C18 Aliphatics	78	NA		5.9E-08	1.5E-08	5.7E+00	2.7E-09	2.42%
C19-C36 Aliphatics	990	NA		7.5E-07	1.9E-07	ND		
C11-C22 Aromatics	110	NA		8.3E-08	2.2E-08	2.0E-01	1.1E-07	97.19%
						SUMMARY HAZARD INDEX	0.0000001	

RES-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.08	mg/cm^2
SURFACE AREA EXPOSED	SA	5,800	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	8.3E-06	0.03	1.1E-06	1.5E+00	1.60E+00	1.2E-05	1.8E-06	1.4E-05	100.00%
					SUMMARY CANCER RISK		1E-05	2E-06	1E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	2.4E-05	0.03	3.4E-06	3.0E-04	2.9E-04	8.0E-02	1.2E-02	9.2E-02	94.73%
Iron	8040	4.7E-03	ND		ND	ND				
Manganese	548	3.2E-04	ND		7.1E-02	ND	4.5E-03		4.5E-03	4.68%
VPH										
C9-C12 Aliphatics	16	9.4E-06	0.17	7.4E-06	6.0E-01	5.5E-01	1.6E-05	1.3E-05	2.9E-05	0.03%
C9-C10 Aromatics	4.85	2.8E-06	0.17	2.2E-06	3.0E-02	2.7E-02	9.5E-05	8.3E-05	1.8E-04	0.18%
EPH										
C9-C18 Aliphatics	3.63	2.1E-06	0.17	1.7E-06	6.0E-01	5.5E-01	3.6E-06	3.1E-06	6.6E-06	0.01%
C19-C36 Aliphatics	38	2.2E-05	0.17	1.8E-05	6.0E+00	5.5E+00	3.7E-06	3.2E-06	6.9E-06	0.01%
C11-C22 Aromatics	10	5.7E-06	0.17	4.5E-06	3.0E-02	2.7E-02	1.9E-04	1.7E-04	3.6E-04	0.37%
				SUMMARY HAZARD INDEX			0.09	0.01	0.1	

RES-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.63	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	3.2E-10	1.5E+01	4.7E-09	100.00%
						SUMMARY CANCER RISK	5E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	9.2E-10	ND		
Iron	8040	NA		6.1E-06	1.8E-07	ND		
Manganese	548	NA		4.2E-07	1.2E-08	1.4E-05	8.8E-04	100.00%
VPH								
C9-C12 Aliphatics	16	NA		1.2E-08	3.6E-10	5.7E-01	6.3E-10	0.00000072
C9-C10 Aromatics	4.85	NA		3.7E-09	1.1E-10	1.7E-02	6.4E-09	0.0000073
EPH								
C9-C18 Aliphatics	3.6	NA		2.8E-09	8.1E-11	5.7E-01	1.4E-10	0.00000016
C19-C36 Aliphatics	38	NA		2.9E-08	8.5E-10	ND		
C11-C22 Aromatics	10	NA		7.4E-09	2.2E-10	2.0E-02	1.1E-08	0.000012
						SUMMARY HAZARD INDEX	0.001	

RES-SS3I

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME

UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)

AOC 57 AREA 3 INDUSTRIAL

FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	2,045	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:

For noncarcinogenic effects: AT = ED

The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.

*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.

ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS3I

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME

UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)

AOC 57 AREA 3 INDUSTRIAL

FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	1.9E-05	0.03	5.9E-06	1.5E+00	1.60E+00	2.9E-05	9.5E-06	3.8E-05	100.00%
					SUMMARY CANCER RISK		3E-05	9E-06	4E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	2.2E-04	0.03	6.9E-05	3.0E-04	2.9E-04	7.5E-01	2.4E-01	9.9E-01	95.11%
Iron	8040	4.4E-02	ND		ND	ND				
Manganese	548	3.0E-03	ND		7.1E-02	ND	4.2E-02		4.2E-02	4.08%
VPH										
C9-C12 Aliphatics	16	8.8E-05	0.17	1.5E-04	6.0E-01	5.5E-01	1.5E-04	2.8E-04	4.2E-04	0.04%
C9-C10 Aromatics	4.85	2.7E-05	0.17	4.6E-05	3.0E-02	2.7E-02	8.9E-04	1.7E-03	2.6E-03	0.25%
EPH										
C9-C18 Aliphatics	3.63	2.0E-05	0.17	3.5E-05	6.0E-01	5.5E-01	3.3E-05	6.3E-05	9.6E-05	0.01%
C19-C36 Aliphatics	38	2.1E-04	0.17	3.6E-04	6.0E+00	5.5E+00	3.5E-05	6.6E-05	1.0E-04	0.01%
C11-C22 Aromatics	10	5.3E-05	0.17	9.3E-05	3.0E-02	2.7E-02	1.8E-03	3.4E-03	5.2E-03	0.50%
				SUMMARY HAZARD INDEX			0.8	0.2	1.0	

RES-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m³
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m³
VOLATILIZATION FACTOR**	VF	Calculated	m³/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m³
INHALATION RATE	IhR	0.31	m³/hour
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	1.8E-10	1.5E+01	2.7E-09	100.00%
						SUMMARY CANCER RISK	3E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	41	NA		3.1E-08	2.1E-09	ND		
Iron	8040	NA		6.1E-06	4.1E-07	ND		
Manganese	548	NA		4.2E-07	2.8E-08	1.4E-05	2.0E-03	100.00%
VPH								
C9-C12 Aliphatics	16	NA		1.2E-08	8.2E-10	5.7E-01	1.4E-09	0.00000072
C9-C10 Aromatics	4.85	NA		3.7E-09	2.5E-10	1.7E-02	1.5E-08	0.0000073
EPH								
C9-C18 Aliphatics	3.6	NA		2.8E-09	1.9E-10	5.7E-01	3.3E-10	0.00000016
C19-C36 Aliphatics	38	NA		2.9E-08	2.0E-09	ND		
C11-C22 Aromatics	10	NA		7.4E-09	5.0E-10	2.0E-02	2.5E-08	0.000012
						SUMMARY HAZARD INDEX	0.002	

RES-SB3I

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME

UNRESTRICTED LAND USE - ADULT RESIDENT

AOC 57 AREA 3 INDUSTRIAL

FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.08	mg/cm^2
SURFACE AREA EXPOSED	SA	5,800	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:

For noncarcinogenic effects: AT = ED

The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.

*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.

ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.67	1.9E-06	0.03	2.7E-07	1.5E+00	1.60E+00	2.9E-06	4.3E-07	3.4E-06	100.00%
					SUMMARY CANCER RISK		3E-06	4E-07	3E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.67	5.7E-06	0.03	7.9E-07	3.0E-04	2.9E-04	1.9E-02	2.7E-03	2.2E-02	83.19%
Iron	6410	3.8E-03	ND		ND	ND				
VPH										
C9-C12 Aliphatics	0.84	4.9E-07	0.17	3.9E-07	6.0E-01	5.5E-01	8.2E-07	7.1E-07	1.5E-06	0.006%
C9-C10 Aromatics	0.35	2.1E-07	0.17	1.6E-07	3.0E-02	2.7E-02	6.8E-06	6.0E-06	1.3E-05	0.05%
EPH										
C9-C18 Aliphatics	78	4.6E-05	0.17	3.6E-05	6.0E-01	5.5E-01	7.6E-05	6.6E-05	1.4E-04	0.55%
C19-C36 Aliphatics	990	5.8E-04	0.17	4.6E-04	6.0E+00	5.5E+00	9.7E-05	8.3E-05	1.8E-04	0.69%
C11-C22 Aromatics	110	6.5E-05	0.17	5.1E-05	3.0E-02	2.7E-02	2.2E-03	1.9E-03	4.0E-03	15.52%
				SUMMARY HAZARD INDEX			0.02	0.005	0.03	

RES-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m³
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m³
VOLATILIZATION FACTOR**	VF	Calculated	m³/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m³
INHALATION RATE	IhR	0.63	m³/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.67	NA		7.3E-09	7.4E-11	1.5E+01	1.1E-09	100.00%
						SUMMARY CANCER RISK	1E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.67	NA		7.3E-09	2.2E-10	ND		
Iron	6410	NA		4.9E-06	1.4E-07	ND		
VPH								
C9-C12 Aliphatics	0.84	NA		6.4E-10	1.9E-11	5.7E-01	3.3E-11	0.03%
C9-C10 Aromatics	0.35	NA		2.7E-10	7.8E-12	1.7E-02	4.6E-10	0.36%
EPH								
C9-C18 Aliphatics	78	NA		5.9E-08	1.7E-09	5.7E-01	3.1E-09	2.42%
C19-C36 Aliphatics	990	NA		7.5E-07	2.2E-08	ND		
C11-C22 Aromatics	110	NA		8.3E-08	2.5E-09	2.0E-02	1.2E-07	97.19%
						SUMMARY HAZARD INDEX	0.0000001	

RES-SB3I

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME

UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)

AOC 57 AREA 3 INDUSTRIAL

FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	2,045	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:

For noncarcinogenic effects: AT = ED

The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.

*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.

ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.67	4.5E-06	0.03	1.4E-06	1.5E+00	1.60E+00	6.8E-06	2.2E-06	9.0E-06	100.00%
					SUMMARY CANCER RISK		7E-06	2E-06	9E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.67	5.3E-05	0.03	1.6E-05	3.0E-04	2.9E-04	1.8E-01	5.6E-02	2.3E-01	78.48%
Iron	6410	3.5E-02	ND		ND	ND				
VPH										
C9-C12 Aliphatics	0.84	4.6E-06	0.17	8.0E-06	6.0E-01	5.5E-01	7.7E-06	1.5E-05	2.2E-05	0.007%
C9-C10 Aromatics	0.35	1.9E-06	0.17	3.3E-06	3.0E-02	2.7E-02	6.4E-05	1.2E-04	1.9E-04	0.06%
EPH										
C9-C18 Aliphatics	78	4.3E-04	0.17	7.4E-04	6.0E-01	5.5E-01	7.1E-04	1.4E-03	2.1E-03	0.70%
C19-C36 Aliphatics	990	5.4E-03	0.17	9.4E-03	6.0E+00	5.5E+00	9.0E-04	1.7E-03	2.6E-03	0.88%
C11-C22 Aromatics	110	6.0E-04	0.17	1.0E-03	3.0E-02	2.7E-02	2.0E-02	3.9E-02	5.9E-02	19.87%
				SUMMARY HAZARD INDEX			0.2	0.1	0.3	

RES-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.31	$m^3/hour$
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	9.67	NA		7.3E-09	4.3E-11	1.5E+01	6.4E-10	100.00%
						SUMMARY CANCER RISK	6E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m³)	AIR CONCENTRATION PARTICULATES (mg/m³)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	9.67	NA		7.3E-09	5.0E-10	ND		
Iron	6410	NA		4.9E-06	3.3E-07	ND		
VPH								
C9-C12 Aliphatics	0.84	NA		6.4E-10	4.3E-11	5.7E-01	7.6E-11	0.03%
C9-C10 Aromatics	0.35	NA		2.7E-10	1.8E-11	1.7E-02	1.1E-09	0.36%
EPH								
C9-C18 Aliphatics	78	NA		5.9E-08	4.0E-09	5.7E-01	7.0E-09	2.42%
C19-C36 Aliphatics	990	NA		7.5E-07	5.1E-08	ND		
C11-C22 Aromatics	110	NA		8.3E-08	5.7E-09	2.0E-02	2.8E-07	97.19%
						SUMMARY HAZARD INDEX	0.0000003	

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	chemical-specific	ug/liter
INGESTION RATE	IR	2	liters/day
BODY WEIGHT	BW	70	kg
CONVERSION FACTOR	CF	0.001	mg/ug
EXPOSURE FREQUENCY	EF	350	days/year
EXPOSURE DURATION	ED	30	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	30	years

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
Arsenic	33.2	ug/Liter	3.9E-04	1.5E+00	5.8E-04
Cadmium	8.67	ug/Liter	1.0E-04	ND	
1,4-Dichlorobenzene	5.6	ug/Liter	6.6E-05	2.4E-02	1.6E-06
Naphthalene	20	ug/Liter	2.3E-04	ND	
Carbon Tetrachloride	4.5	ug/Liter	5.3E-05	1.3E-01	6.9E-06
Chlorofoem	10	ug/Liter	1.2E-04	6.1E-03	7.2E-07
Tetrachloroethene	2.6	ug/Liter	3.1E-05	5.2E-02	1.6E-06
			TOTAL CANCER RISK		6E-04

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Aluminum	190	ug/Liter	5.2E-03	1.0E+00	5.2E-03
Arsenic	33.2	ug/Liter	9.1E-04	3.0E-04	3.0E+00
Cadmium	8.67	ug/Liter	2.4E-04	5.0E-04	4.8E-01
Iron	12400	ug/Liter	3.4E-01	ND	
Manganese	466	ug/Liter	1.3E-02	2.4E-02	5.3E-01
1,2-Dichlorobenzene	9.8	ug/Liter	2.7E-04	9.0E-02	3.0E-03
1,4-Dichlorobenzene	5.6	ug/Liter	1.5E-04	3.0E-02	5.1E-03
Naphthalene	20	ug/Liter	5.5E-04	2.0E-02	2.7E-02
Carbon Tetrachloride	4.5	ug/Liter	1.2E-04	7.0E-04	1.8E-01
Chloroform	10	ug/Liter	2.7E-04	1.0E-02	2.7E-02
Tetrachloroethene	2.6	ug/Liter	7.1E-05	1.0E-02	7.1E-03
C9-C10 Aromatics	310	ug/Liter	8.5E-03	3.0E-02	2.8E-01
			TOTAL HAZARD INDEX		5

RECCH-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	3,850	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	38	kg
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RECCH-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	1.6E-06	0.03	1.9E-06	1.5E+00	1.6E+00	2.5E-06	3.0E-06	5.5E-06	97.67%
Dieldrin	0.14	8.2E-09	ND	0.0E+00	1.6E+01	ND	1.3E-07		1.3E-07	2.33%
					SUMMARY CANCER RISK		3E-06	3E-06	6E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	1.0E-05	0.03	1.2E-05	3.0E-04	2.9E-04	3.5E-02	4.2E-02	7.7E-02	15.81%
Manganese	170	6.4E-05	ND		7.1E-02	ND	9.0E-04		9.0E-04	0.18%
Dieldrin	0.14	5.2E-08	ND		5.0E-05	ND	1.0E-03		1.0E-03	0.22%
VPH										
C9-C12 Aliphatics	1500	5.6E-04	0.17	3.7E-03	6.0E-01	5.5E-01	9.4E-04	6.7E-03	7.6E-03	1.57%
C9-C10 Aromatics	600	2.2E-04	0.17	1.5E-03	3.0E-02	2.7E-02	7.5E-03	5.5E-02	6.2E-02	12.77%
EPH										
C9-C18 Aliphatics	1300	4.9E-04	0.17	3.2E-03	6.0E-01	5.5E-01	8.1E-04	5.8E-03	6.6E-03	1.36%
C19-C36 Aliphatics	20,000	7.5E-03	0.17	4.9E-02	6.0E+00	5.5E+00	1.2E-03	8.9E-03	1.0E-02	2.09%
C11-C22 Aromatics	3100	1.2E-03	0.17	7.6E-03	3.0E-02	2.7E-02	3.9E-02	2.8E-01	3.2E-01	65.99%
				SUMMARY HAZARD INDEX			0.09	0.4	0.5	

RECCH-SD3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SEDIMENT	CS	See Below*	mg/kg
INGESTION RATE	IR	25	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm^2
SURFACE AREA EXPOSED	SA	3,850	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	38	kg
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RECCH-SD3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SEDIMENT CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	37	5.4E-07	0.03	2.5E-06	1.5E+00	1.6E+00	8.2E-07	4.0E-06	4.8E-06	87.51%
Aroclor-1260	0.84	1.2E-08	0.14	2.7E-07	2.0E+00	2.5E+00	2.5E-08	6.7E-07	6.9E-07	12.49%
					SUMMARY CANCER RISK		8E-07	5E-06	6E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SEDIMENT CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	37	3.5E-06	0.03	1.6E-05	3.0E-04	2.9E-04	1.2E-02	5.5E-02	6.7E-02	48.47%
Manganese	459	4.3E-05	ND		7.1E-02	4.3E-03	6.1E-04	0.0E+00	6.1E-04	0.44%
Aroclor-1260	0.84	7.9E-08	0.14	1.7E-06	2.0E-05	1.6E-05	3.9E-03	1.1E-01	1.1E-01	79.83%
EPH Fractions										
C11-C22 Aromatics	280	2.6E-05	0.17	6.9E-04	3.0E-02	2.7E-02	8.7E-04	2.5E-02	2.6E-02	19.10%
C19-C36 Aliphatics	630	5.9E-05	0.17	1.5E-03	6.0E+00	5.5E+00	9.8E-06	2.8E-04	2.9E-04	0.211%
VPH Fractions										
C5-C8 Aliphatics	3.3	3.1E-07	0.17	8.1E-06	6.0E-02	5.5E-02	5.2E-06	1.5E-04	1.5E-04	0.111%
C9-C10 Aromatics	4.3	4.0E-07	0.17	1.1E-05	3.0E-02	2.7E-02	1.3E-05	3.9E-04	4.0E-04	0.293%
C9-C12 Aliphatics	5.6	5.2E-07	0.17	1.4E-05	6.0E-01	5.5E-01	8.7E-07	2.5E-05	2.6E-05	0.0188%
				SUMMARY HAZARD INDEX			0.01	0.1	0.1	

RECCH-SW3R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA
EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	average	mg/liter
INGESTION RATE	IR	0.013	liters/hour
SURFACE AREA EXPOSED	SA	2,518	cm^2/day
CONVERSION FACTOR	CF	0.001	liter/cm^3
BODY WEIGHT	BW	38	kg
EXPOSURE TIME	ET	2	hours/day
EXPOSURE FREQUENCY	EF	52	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
PERMEABILITY COEFFICIENT	Kpevent	Chemical-specific	cm/day

Notes:
For noncarcinogenic effects: AT = ED
ND - Value not determined
TPHC - Total Petroleum Hydrocarbons

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{\text{CW x IR x ET x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{\text{CW x Kpevent x ET xSA x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

RECCH-SW3R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA
CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/L)	INTAKE INGESTION (mg/kg-day)	PERMEABILITY COEFFICIENT (cm/hour)	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR		CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
					ORAL (mg/kg-day)$^{-1}$	DERMAL (mg/kg-day)$^{-1}$				
Arsenic	0.153	2.3E-06	1.0E-03	4.5E-07	1.5E+00	1.6E+00	3.5E-06	7.3E-07	4.2E-06	93.90%
Benzo(k)fluoranthene	0.00094	1.4E-08	1.2E+00	3.3E-06	7.3E-02	8.2E-02	1.1E-09	2.7E-07	2.8E-07	6.10%
					SUMMARY CANCER RISK		4E-06	1E-06	5E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/L)	INTAKE INGESTION (mg/kg-day)	PERMEABILITY COEFFICIENT (cm/hour)	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE		HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
					ORAL (mg/kg-day)	DERMAL (mg/kg-day)				
Antimony	0.0056	5.5E-07	1.0E-03	1.1E-07	4.0E-04	6.0E-05	1.36E-03	1.76E-03	3.1E-03	4.59%
Arsenic	0.153	1.5E-05	1.0E-03	2.9E-06	3.0E-04	2.9E-04	4.97E-02	9.96E-03	6.0E-02	87.62%
Barium	0.278	2.7E-05	1.0E-03	5.2E-06	7.0E-02	4.9E-03	3.87E-04	1.07E-03	1.5E-03	2.14%
Manganese	0.093	9.1E-06	1.0E-03	1.8E-06	2.4E-02	1.4E-03	3.78E-04	1.25E-03	1.6E-03	2.40%
Benzo(k)fluoranthene	0.00094	9.2E-08	1.2E+00		ND	ND				
EPH Fractions										
C10-C22 Aromatics	0.65	6.3E-05	NA		3.0E-02	2.7E-02	2.11E-03		2.1E-03	3.10%
C19-C36 Aliphatics	1.1	1.1E-04	NA		6.0E+00	5.5E+00	1.79E-05		1.8E-05	0.026%
VPH Fractions										
C9-C10 Aromatics	0.025	2.4E-06	NA		3.0E-02	2.7E-02	8.12E-05		8.1E-05	0.12%
					SUMMARY HAZARD INDEX		0.1	0.01	0.1	

RECCH-SS3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	50	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²
SURFACE AREA EXPOSED	SA	3,850	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	38	kg
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{\text{CS x IR x FI x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{\text{CS x SA x SAF x AE x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

RECCH-SS3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	4.1E-07	0.03	9.5E-07	1.5E+00	1.6E+00	6.2E-07	1.5E-06	2.1E-06	100.00%
Dieldrin	0.14	2.1E-09	ND	0.0E+00	ND	ND				
					SUMMARY CANCER RISK		6E-07	2E-06	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	2.6E-06	0.03	6.1E-06	3.0E-04	2.9E-04	8.7E-03	2.1E-02	3.0E-02	13.40%
Manganese	170	1.6E-05	ND		7.1E-02	ND	2.2E-04		2.2E-04	0.10%
Dieldrin	0.14	1.3E-08	ND		5.0E-05	ND	2.6E-04		2.6E-04	0.12%
VPH										
C9-C12 Aliphatics	1500	1.4E-04	0.17	1.8E-03	6.0E-01	5.5E-01	2.3E-04	3.3E-03	3.6E-03	1.62%
C9-C10 Aromatics	600	5.6E-05	0.17	7.4E-04	3.0E-02	2.7E-02	1.9E-03	2.7E-02	2.9E-02	13.17%
EPH										
C9-C18 Aliphatics	1300	1.2E-04	0.17	1.6E-03	6.0E-01	5.5E-01	2.0E-04	2.9E-03	3.1E-03	1.40%
C19-C36 Aliphatics	20,000	1.9E-03	0.17	2.5E-02	6.0E+00	5.5E+00	3.1E-04	4.5E-03	4.8E-03	2.16%
C11-C22 Aromatics	3100	2.9E-04	0.17	3.8E-03	3.0E-02	2.7E-02	9.7E-03	1.4E-01	1.5E-01	68.03%
				SUMMARY HAZARD INDEX			0.02	0.2	0.2	

RECCH-SD3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SEDIMENT	CS	See Below*	mg/kg
INGESTION RATE	IR	25	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²
SURFACE AREA EXPOSED	SA	3,850	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	38	kg
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RECCH-SD3R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - CENTRAL TENDENCY

CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)

AOC 57 AREA 3 RECREATIONAL

FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SEDIMENT CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	37	2.7E-07	0.03	1.3E-06	1.5E+00	1.6E+00	4.1E-07	2.0E-06	2.4E-06	87.51%
Aroclor-1260	0.84	6.2E-09	0.14	1.3E-07	2.0E+00	2.5E+00	1.2E-08	3.3E-07	3.5E-07	12.49%
SUMMARY CANCER RISK							4E-07	2E-06	3E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SEDIMENT CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	37	1.7E-06	0.03	8.0E-06	3.0E-04	2.9E-04	5.8E-03	2.8E-02	3.3E-02	48.47%
Manganese	459	2.2E-05	ND		7.1E-02	4.3E-03	3.0E-04	0.0E+00	3.0E-04	0.44%
Aroclor-1260	0.84	3.9E-08	0.14	8.5E-07	2.0E-05	1.6E-05	2.0E-03	5.3E-02	5.5E-02	79.83%
EPH Fractions										
C11-C22 Aromatics	280	1.3E-05	0.17	3.4E-04	3.0E-02	2.7E-02	4.4E-04	1.3E-02	1.3E-02	19.10%
C19-C36 Aliphatics	630	3.0E-05	0.17	7.7E-04	6.0E+00	5.5E+00	4.9E-06	1.4E-04	1.5E-04	0.211%
VPH Fractions										
C5-C8 Aliphatics	3.3	1.5E-07	0.17	4.0E-06	6.0E-02	5.5E-02	2.6E-06	7.4E-05	7.6E-05	0.111%
C9-C10 Aromatics	4.3	2.0E-07	0.17	5.3E-06	3.0E-02	2.7E-02	6.7E-06	2.0E-04	2.0E-04	0.293%
C9-C12 Aliphatics	5.6	2.6E-07	0.17	6.9E-06	6.0E-01	5.5E-01	4.4E-07	1.2E-05	1.3E-05	0.0188%
SUMMARY HAZARD INDEX							0.003	0.07	0.07	

RECCH-SW3R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA
EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	average	mg/liter
INGESTION RATE	IR	0.013	liters/hour
SURFACE AREA EXPOSED	SA	2,518	cm^2/day
CONVERSION FACTOR	CF	0.001	liter/cm^3
BODY WEIGHT	BW	38	kg
EXPOSURE TIME	ET	2	hours/day
EXPOSURE FREQUENCY	EF	26	days/year
EXPOSURE DURATION	ED	11	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	11	years
PERMEABILITY COEFFICIENT	Kpevent	Chemical-specific	cm/day

Notes:
For noncarcinogenic effects: AT = ED
ND - Value not determined
TPHC - Total Petroleum Hydrocarbons

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(\text{mg/kg-day})^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{\text{CW x IR x ET x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{\text{CW x Kpevent x ET xSA x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA
CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/L)	INTAKE INGESTION (mg/kg-day)	PERMEABILITY COEFFICIENT (cm/hour)	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)$^{-1}$	CANCER SLOPE FACTOR DERMAL (mg/kg-day)$^{-1}$	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	0.153	1.2E-06	1.0E-03	2.3E-07	1.5E+00	1.6E+00	1.8E-06	3.6E-07	2.1E-06	93.90%
Benzo(k)fluoranthene	0.00094	7.2E-09	1.2E+00	1.7E-06	7.3E-02	8.2E-02	5.3E-10	1.4E-07	1.4E-07	6.10%
					SUMMARY CANCER RISK		2E-06	5E-07	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION (mg/L)	INTAKE INGESTION (mg/kg-day)	PERMEABILITY COEFFICIENT (cm/hour)	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Antimony	0.0056	2.7E-07	1.0E-03	5.3E-08	4.0E-04	6.0E-05	6.82E-04	8.81E-04	1.6E-03	4.59%
Arsenic	0.153	7.5E-06	1.0E-03	1.4E-06	3.0E-04	2.9E-04	2.49E-02	4.98E-03	3.0E-02	87.62%
Barium	0.278	1.4E-05	1.0E-03	2.6E-06	7.0E-02	4.9E-03	1.94E-04	5.36E-04	7.3E-04	2.14%
Manganese	0.093	4.5E-06	1.0E-03	8.8E-07	2.4E-02	1.4E-03	1.89E-04	6.27E-04	8.2E-04	2.40%
Benzo(k)fluoranthene	0.00094	4.6E-08	1.2E+00		ND	ND				
EPH Fractions										
C10-C22 Aromatics	0.65	3.2E-05	NA		3.0E-02	2.7E-02	1.06E-03		1.1E-03	3.10%
C19-C36 Aliphatics	1.1	5.4E-05	NA		6.0E+00	5.5E+00	8.94E-06		8.9E-06	0.026%
VPH Fractions										
C9-C10 Aromatics	0.025	1.2E-06	NA		3.0E-02	2.7E-02	4.06E-05		4.1E-05	0.12%
					SUMMARY HAZARD INDEX		0.03	0.01	0.03	

CON-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

16-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm²
SURFACE AREA	SA	5200	cm2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.5	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

CON-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	9.4E-07	0.03	8.5E-08	1.5E+00	1.60E+00	1.4E-06	1.4E-07	1.5E-06	95.36%
Dieldrin	0.14	4.7E-09	ND	0.0E+00	1.6E+01	ND	7.5E-08		7.5E-08	4.64%
					SUMMARY CANCER RISK		1E-06	1E-07	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	1.3E-04	0.03	1.2E-05	3.0E-04	2.9E-04	4.4E-01	4.1E-02	4.8E-01	79.80%
Manganese	170	8.0E-04	ND	0.0E+00	7.1E-02	4.30E-03	1.1E-02	0.0E+00	1.1E-02	1.87%
Dieldrin	0.14	6.6E-07	ND	0.0E+00	5.0E-05	ND	1.3E-02		1.3E-02	2.19%
VPH										
C9-C12 Aliphatics	1500	7.0E-03	0.17	3.6E-03	6.0E+00	5.5E+00	1.2E-03	6.6E-04	1.8E-03	0.31%
C9-C10 Aromatics	600	2.8E-03	0.17	1.5E-03	3.0E-01	2.7E-01	9.4E-03	5.4E-03	1.5E-02	2.46%
EPH										
C9-C18 Aliphatics	1,300.0	6.1E-03	0.17	3.1E-03	6.0E+00	5.5E+00	1.0E-03	5.7E-04	1.6E-03	0.26%
C19-C36 Aliphatics	20,000	9.4E-02	0.17	4.8E-02	6.0E+01	5.5E+01	1.6E-03	8.8E-04	2.4E-03	0.41%
C11-C22 Aromatics	3,100	1.5E-02	0.17	7.5E-03	3.0E-01	2.7E-01	4.9E-02	2.8E-02	7.6E-02	12.70%
				SUMMARY HAZARD INDEX			0.5	0.08	0.6	

CON-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	m^3/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.50	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	3.9E-11	1.5E+01	5.9E-10	99.47%
Dieldrin	0.14	NA		1.1E-10	2.0E-13	1.6E+01	3.1E-12	0.53%
						SUMMARY CANCER RISK	6E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	5.5E-09	ND		
Manganese	170	NA		1.3E-07	3.3E-08	1.4E-05	2.4E-03	99.84%
Dieldrin	0.14			1.1E-10	2.7E-11	ND		
VPH								
C9-C12 Aliphatics	1500	NA		1.1E-06	2.9E-07	5.7E+00	5.1E-08	0.0022%
C9-C10 Aromatics	600	NA		4.5E-07	1.2E-07	1.7E-01	6.9E-07	0.029%
EPH								
C9-C18 Aliphatics	1,300.0	NA		9.8E-07	2.5E-07	5.7E+00	4.5E-08	0.0019%
C19-C36 Aliphatics	20,000	NA		1.5E-05	3.9E-06	ND		
C11-C22 Aromatics	3,100	NA		2.3E-06	6.1E-07	2.0E-01	3.0E-06	0.13%
						SUMMARY HAZARD INDEX	0.002	

CON-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.5	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28.2	9.5E-07	0.03	8.6E-08	1.5E+00	1.60E+00	1.4E-06	1.4E-07	1.6E-06	100.00%
SUMMARY CANCER RISK							1E-06	1E-07	2E-06	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28.2	1.3E-04	0.03	1.2E-05	3.0E-04	2.9E-04	4.4E-01	4.2E-02	4.8E-01	100.00%
SUMMARY HAZARD INDEX							0.4	0.04	0.5	

CON-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	m^3/hour
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.5	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.50	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	28.2	NA		2.1E-08	3.9E-11	1.5E+01	5.9E-10	100.00%
						SUMMARY CANCER RISK	6E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28.2	NA		2.1E-08	5.5E-09	ND		
						SUMMARY HAZARD INDEX	0.0	

CON-SS3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

16-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm²
SURFACE AREA	SA	5200	cm2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

CON-SS3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	4.7E-07	0.03	4.3E-08	1.5E+00	1.60E+00	7.0E-07	6.8E-08	7.7E-07	95.36%
Dieldrin	0.14	2.3E-09	ND	0.0E+00	1.6E+01	ND	3.8E-08		3.8E-08	4.64%
					SUMMARY CANCER RISK		7E-07	7E-08	8E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	1.3E-04	0.03	1.2E-05	3.0E-04	2.9E-04	4.4E-01	4.1E-02	4.8E-01	79.80%
Manganese	170	8.0E-04	ND	0.0E+00	7.1E-02	4.30E-03	1.1E-02	0.0E+00	1.1E-02	1.87%
Dieldrin	0.14	6.6E-07	ND	0.0E+00	5.0E-05	ND	1.3E-02		1.3E-02	2.19%
VPH										
C9-C12 Aliphatics	1500	7.0E-03	0.17	3.6E-03	6.0E+00	5.5E+00	1.2E-03	6.6E-04	1.8E-03	0.31%
C9-C10 Aromatics	600	2.8E-03	0.17	1.5E-03	3.0E-01	2.7E-01	9.4E-03	5.4E-03	1.5E-02	2.46%
EPH										
C9-C18 Aliphatics	1,300.0	6.1E-03	0.17	3.1E-03	6.0E+00	5.5E+00	1.0E-03	5.7E-04	1.6E-03	0.26%
C19-C36 Aliphatics	20,000	9.4E-02	0.17	4.8E-02	6.0E+01	5.5E+01	1.6E-03	8.8E-04	2.4E-03	0.41%
C11-C22 Aromatics	3,100	1.5E-02	0.17	7.5E-03	3.0E-01	2.7E-01	4.9E-02	2.8E-02	7.6E-02	12.70%
					SUMMARY HAZARD INDEX		0.5	0.08	0.6	

CON-SS3R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

INTAKE - INHALATION = $\frac{(CAp + CAv) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS3R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	2.0E-11	1.5E+01	2.9E-10	99.47%
Dieldrin	0.14	NA		1.1E-10	9.8E-14	1.6E+01	1.6E-12	0.53%
						SUMMARY CANCER RISK	3E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	5.5E-09	ND		
Manganese	170	NA		1.3E-07	3.3E-08	1.4E-05	2.4E-03	99.84%
Dieldrin	0.14			1.1E-10	2.7E-11	ND		
VPH								
C9-C12 Aliphatics	1500	NA		1.1E-06	2.9E-07	5.7E+00	5.1E-08	0.0022%
C9-C10 Aromatics	600	NA		4.5E-07	1.2E-07	1.7E-01	6.9E-07	0.029%
EPH								
C9-C18 Aliphatics	1,300.0	NA		9.8E-07	2.5E-07	5.7E+00	4.5E-08	0.0019%
C19-C36 Aliphatics	20,000	NA		1.5E-05	3.9E-06	ND		
C11-C22 Aromatics	3,100	NA		2.3E-06	6.1E-07	2.0E-01	3.0E-06	0.13%
						SUMMARY HAZARD INDEX	0.002	

CON-SB3R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	3.3	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB3R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	28.2	NA		2.1E-08	2.0E-11	1.5E+01	3.0E-10	100.00%
						SUMMARY CANCER RISK	3E-10	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28.2	NA		2.1E-08	5.5E-09	ND		
						SUMMARY HAZARD INDEX	0	

CON-SB3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	480	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.28	mg/cm^2
SURFACE AREA	SA	5200	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	250	days/year
EXPOSURE DURATION	ED	0.25	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	0.25	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28.2	4.7E-07	0.03	4.3E-08	1.5E+00	1.60E+00	7.1E-07	6.9E-08	7.8E-07	100.00%
					SUMMARY CANCER RISK		7E-07	7E-08	8E-07	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28.2	1.3E-04	0.03	1.2E-05	3.0E-04	2.9E-04	4.4E-01	4.2E-02	4.8E-01	100.00%
				SUMMARY HAZARD INDEX			0.4	0.04	0.5	

RES-SS3R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME

UNRESTRICTED LAND USE - ADULT RESIDENT

AOC 57 AREA 3 RECREATIONAL

FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.08	mg/cm^2
SURFACE AREA EXPOSED	SA	5,800	cm^2
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:

For noncarcinogenic effects: AT = ED

The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.

*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.

ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	5.6E-06	0.03	7.8E-07	1.5E+00	1.6E+00	8.5E-06	1.3E-06	9.7E-06	95.56%
Dieldrin	0.14	2.8E-08	ND	0.0E+00	1.6E+01	ND	4.5E-07		4.5E-07	4.44%
SUMMARY CANCER RISK							9E-06	1E-06	1E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	1.6E-05	0.03	2.3E-06	3.0E-04	2.9E-04	5.5E-02	7.9E-03	6.3E-02	29.80%
Manganese	170	1.0E-04	ND		7.1E-02	ND	1.4E-03		1.4E-03	0.67%
Dieldrin	0.14	8.2E-08	ND		5.0E-05	ND	1.6E-03		1.6E-03	0.78%
VPH										
C9-C12 Aliphatics	1500	8.8E-04	0.17	6.9E-04	6.0E-01	5.5E-01	1.5E-03	1.3E-03	2.7E-03	1.30%
C9-C10 Aromatics	600	3.5E-04	0.17	2.8E-04	3.0E-02	2.7E-02	1.2E-02	1.0E-02	2.2E-02	10.47%
EPH										
C9-C18 Aliphatics	1300	7.6E-04	0.17	6.0E-04	6.0E-01	5.5E-01	1.3E-03	1.1E-03	2.4E-03	1.13%
C19-C36 Aliphatics	20,000	1.2E-02	0.17	9.3E-03	6.0E+00	5.5E+00	2.0E-03	1.7E-03	3.6E-03	1.73%
C11-C22 Aromatics	3,100	1.8E-03	0.17	1.4E-03	3.0E-02	2.7E-02	6.1E-02	5.3E-02	1.1E-01	54.12%
SUMMARY HAZARD INDEX							0.1	0.08	0.2	

RES-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.63	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	2.2E-10	1.5E+01	3.2E-09	99.47%
Dieldrin	0.14	NA		1.1E-10	1.1E-12	1.6E+01	1.7E-11	0.53%
						SUMMARY CANCER RISK	3E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	6.3E-10	ND		
Manganese	170	NA		1.3E-07	3.8E-09	1.4E-05	2.7E-04	98.42%
Dieldrin	0.14	NA		1.1E-10	3.1E-12	ND		
VPH								
C9-C12 Aliphatics	1500	NA		1.1E-06	3.4E-08	5.7E-01	5.9E-08	0.021%
C9-C10 Aromatics	600	NA		4.5E-07	1.3E-08	1.7E-02	7.9E-07	0.29%
EPH								
C9-C18 Aliphatics	1300	NA		9.8E-07	2.9E-08	5.7E-01	5.1E-08	0.018%
C19-C36 Aliphatics	20,000	NA		1.5E-05	4.5E-07	ND		
C11-C22 Aromatics	3,100	NA		2.3E-06	6.9E-08	2.0E-02	3.5E-06	1.26%
						SUMMARY HAZARD INDEX	0.0003	

RES-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²
SURFACE AREA EXPOSED	SA	2,045	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{\text{CS x IR x FI x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{\text{CS x SA x SAF x AE x CF x EF x ED}}{\text{BW x AT x 365 days/yr}}$$

RES-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	1.3E-05	0.03	4.0E-06	1.5E+00	1.60E+00	2.0E-05	6.5E-06	2.6E-05	96.14%
Dieldrin	0.14	6.6E-08	ND	0.0E+00	1.6E+01	ND	1.1E-06		1.1E-06	3.86%
					SUMMARY CANCER RISK		2E-05	6E-06	3E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	1.5E-04	0.03	4.7E-05	3.0E-04	2.9E-04	5.1E-01	1.6E-01	6.7E-01	23.97%
Manganese	170	9.3E-04	ND		7.1E-02	ND	1.3E-02		1.3E-02	0.47%
Dieldrin	0.14	7.7E-07	ND		5.0E-05	ND	1.5E-02		1.5E-02	0.55%
VPH										
C9-C12 Aliphatics	1500	8.2E-03	0.17	1.4E-02	6.0E-01	5.5E-01	1.4E-02	2.6E-02	4.0E-02	1.41%
C9-C10 Aromatics	600	3.3E-03	0.17	5.7E-03	3.0E-02	2.7E-02	1.1E-01	2.1E-01	3.2E-01	11.43%
EPH										
C9-C18 Aliphatics	1300	7.1E-03	0.17	1.2E-02	6.0E-01	5.5E-01	1.2E-02	2.3E-02	3.4E-02	1.22%
C19-C36 Aliphatics	20,000	1.1E-01	0.17	1.9E-01	6.0E+00	5.5E+00	1.8E-02	3.5E-02	5.3E-02	1.88%
C11-C22 Aromatics	3,100	1.7E-02	0.17	3.0E-02	3.0E-02	2.7E-02	5.7E-01	1.1E+00	1.7E+00	59.06%
				SUMMARY HAZARD INDEX			1	2	3	

RES-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.31	$m^3/hour$
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	1.2E-10	1.5E+01	1.9E-09	99.47%
Dieldrin	0.14	NA		1.1E-10	6.2E-13	1.6E+01	9.9E-12	0.53%
						SUMMARY CANCER RISK	2E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28	NA		2.1E-08	1.4E-09	ND		
Manganese	170	NA		1.3E-07	8.8E-09	1.4E-05	6.3E-04	98.42%
Dieldrin	0.14	NA		1.1E-10	7.2E-12	ND		
<u>VPH</u>								
C9-C12 Aliphatics	1500	NA		1.1E-06	7.7E-08	5.7E-01	1.4E-07	0.021%
C9-C10 Aromatics	600	NA		4.5E-07	3.1E-08	1.7E-02	1.8E-06	0.29%
<u>EPH</u>								
C9-C18 Aliphatics	1300	NA		9.8E-07	6.7E-08	5.7E-01	1.2E-07	0.018%
C19-C36 Aliphatics	20,000	NA		1.5E-05	1.0E-06	ND		
C11-C22 Aromatics	3,100	NA		2.3E-06	1.6E-07	2.0E-02	8.0E-06	1.26%
						SUMMARY HAZARD INDEX	0.0006	

RES-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

02-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	100	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	0.08	mg/cm²
SURFACE AREA EXPOSED	SA	5,800	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	70	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28.2	5.7E-06	0.03	7.9E-07	1.5E+00	1.6E+00	8.5E-06	1.3E-06	9.8E-06	100.00%
SUMMARY CANCER RISK							9E-06	1E-06	1E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28.2	1.7E-05	0.03	2.3E-06	3.0E-04	2.9E-04	5.5E-02	7.9E-03	6.3E-02	100.00%
SUMMARY HAZARD INDEX							0.1	0.01	0.1	

RES-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.63	$m^3/hour$
BODY WEIGHT	BW	70	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	24	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	24	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	28.2	NA		2.1E-08	2.2E-10	1.5E+01	3.3E-09	100.00%
						SUMMARY CANCER RISK	3E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28.2	NA		2.1E-08	6.3E-10	ND		
						SUMMARY HAZARD INDEX	0	

RES-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

02-Feb-00

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL	CS	See Below*	mg/kg
INGESTION RATE	IR	200	mg/day
FRACTION INGESTED	FI	100%	
SOIL ADHERENCE FACTOR	SAF	1	mg/cm²
SURFACE AREA EXPOSED	SA	2,045	cm²
CONVERSION FACTOR	CF	0.000001	kg/mg
BODY WEIGHT	BW	15	kg
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years
DERMAL ABSORPTION EFFICIENCY	AE	Chemical-specific	unitless

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I:
Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

RES-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR ORAL (mg/kg-day)-1	CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK	PERCENT TOTAL RISK
Arsenic	28.2	1.3E-05	0.03	4.1E-06	1.5E+00	1.60E+00	2.0E-05	6.5E-06	2.6E-05	100.00%
					SUMMARY CANCER RISK		2E-05	7E-06	3E-05	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INTAKE INGESTION (mg/kg-day)	DERMAL ABSORPTION EFFICIENCY	INTAKE DERMAL (mg/kg-day)	REFERENCE DOSE ORAL (mg/kg-day)	REFERENCE DOSE DERMAL (mg/kg-day)	HAZARD QUOTIENT INGESTION	HAZARD QUOTIENT DERMAL	TOTAL HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28.2	1.5E-04	0.03	4.7E-05	3.0E-04	2.9E-04	5.2E-01	1.6E-01	6.8E-01	100.00%
				SUMMARY HAZARD INDEX			0.5	0.2	0.7	

RES-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION SOIL*	CS	See below	mg/kg
CONCENTRATION AIR PARTICULATES	CAp	Calculated	mg/m^3
CONCENTRATION AIR VOLATILES	CAv	Calculated	mg/m^3
VOLATILIZATION FACTOR**	VF	Calculated	m^3/kg
PARTICULATE EMISSIONS FACTOR	PEF	1.32E+09	ug/m^3
INHALATION RATE	IhR	0.31	m^3/hour
BODY WEIGHT	BW	15	kg
EXPOSURE TIME	ET	8	hours/day
EXPOSURE FREQUENCY	EF	150	days/year
EXPOSURE DURATION	ED	6	years
RELATIVE ABSORPTION FACTOR	RAF	100%	
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	6	years

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)-1	CANCER RISK	PERCENT TOTAL RISK
Arsenic	28.2	NA		2.1E-08	1.2E-10	1.5E+01	1.9E-09	100.00%
						SUMMARY CANCER RISK	2E-09	

NONCARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	VF (m^3/kg)	AIR CONCENTRATION VOLATILES (mg/m^3)	AIR CONCENTRATION PARTICULATES (mg/m^3)	INTAKE (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT	PERCENT TOTAL RISK
Arsenic	28.2	NA		2.1E-08	1.5E-09	ND		
						SUMMARY HAZARD INDEX	0	

RES-GW21
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS
CONCENTRATION WATER	CW	chemical-specific	ug/liter
INGESTION RATE	IR	2	liters/day
BODY WEIGHT	BW	70	kg
CONVERSION FACTOR	CF	0.001	mg/ug
EXPOSURE FREQUENCY	EF	350	days/year
EXPOSURE DURATION	ED	30	years
AVERAGING TIME			
CANCER	AT	70	years
NONCANCER	AT	30	years

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{CW \times IR \times EF \times ED \times CF}{BW \times AT \times 365 \text{ days/year}}$$

RES-GW21
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION
Arsenic	84.4	ug/Liter	9.9E-04	1.5E+00	1.5E-03
1,4-Dichlorobenzene	2.7	ug/Liter	3.2E-05	2.4E-02	7.6E-07
Bis(2-ethylhexyl)phthalate	52	ug/Liter	6.1E-04	1.4E-02	8.5E-06
Naphthalene	13	ug/Liter	1.5E-04	ND	
Tetrachloroethene	5.5	ug/Liter	6.5E-05	5.2E-02	3.4E-06
Trichloroethene	3.8	ug/Liter	4.5E-05	1.1E-02	4.9E-07
			TOTAL CANCER RISK		1E-03

NONCARCINOGENIC EFFECTS

COMPOUND	WATER CONCENTRATION	UNITS	INTAKE INGESTION (mg/kg-day)	REFERENCE DOSE (mg/kg-day)	HAZARD QUOTIENT INGESTION
Aluminum	2450	ug/Liter	6.7E-02	1.0E+00	6.7E-02
Arsenic	84.4	ug/Liter	2.3E-03	3.0E-04	7.7E+00
Iron	1910	ug/Liter	5.2E-02	ND	
Manganese	346	ug/Liter	9.5E-03	2.4E-02	3.9E-01
1,4-Dichlorobenzene	2.7	ug/Liter	7.4E-05	3.0E-02	2.5E-03
Bis(2-ethylhexyl)phthalate	52	ug/Liter	1.4E-03	2.0E-02	7.1E-02
Naphthalene	13	ug/Liter	3.6E-04	2.0E-02	1.8E-02
Tetrachloroethene	5.5	ug/Liter	1.5E-04	1.0E-02	1.5E-02
Trichloroethene	3.8	ug/Liter	1.0E-04	6.0E-03	1.7E-02
C5-C8 Aliphatics	89.5	ug/Liter	2.5E-03	6.0E-02	4.1E-02
C9-C12 Aliphatics	42.5	ug/Liter	1.2E-03	6.0E-01	1.9E-03
C9-C10 Aromatics	172	ug/Liter	4.7E-03	3.0E-02	1.6E-01
			TOTAL HAZARD INDEX		8

N-6 RISK SUMMARY TABLES

TABLE 1
RISK ASSESSMENT SUMMARY
AREA 2 - INDUSTRIAL - MAINTENANCE WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Current/Future
Receptor Population: Maintenance worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Industrial	Arsenic	2E-06	2E-09	2E-07	2E-06	Arsenic	Skin	0.014	--	0.0012	0.02
			Chromium	NA	5E-09	NA	5E-09	Chromium	NOAEL (GI)[2]	0.0018	0.000018	--	0.002
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.0014	0.00068	--	0.002
								C9-C12 Aliphatics	Nervous system	0.000011	0.0000000011	0.0000056	0.00002
								C9-C10 Aromatics	Kidney	0.00016	0.000000027	0.000082	0.0002
								C9-C18 Aliphatics	Nervous system	0.00016	0.000000016	0.000081	0.0002
								C19-C36 Aliphatics	Liver	0.00019	--	0.000099	0.0003
								C11-C22 Aromatics	Kidney	0.012	0.0000017	0.0063	0.02
			(Total)	2E-06	7E-09	2E-07	2E-06	(Total)		0.03	0.0007	0.008	0.04
			Total Risk Across All Media and All Exposure Routes				2E-06	Total Hazard Index Across All Media and All Exposure Routes					0.04

Total [Skin] HI =	0.02
Total [GI] HI =	0.002
Total [Nervous system] HI =	0.002
Total [Liver] HI =	0.0003
Total [Kidney] HI =	0.02
Total [NOAEL] HI =	0.004

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 2
RISK ASSESSMENT SUMMARY
AREA 2 - INDUSTRIAL - COMMERCIAL/INDUSTRIAL WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Commercial/industrial worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk: Ingestion	Carcinogenic Risk: Inhalation	Carcinogenic Risk: Dermal	Carcinogenic Risk: Exposure Routes Total
Soil	Surface Soil	Area 2 - Industrial	Arsenic	7E-06	6E-09	4E-07	7E-06
			Chromium	NA	2E-08	NA	2E-08
			(Total)	7E-06	3E-08	4E-07	7E-06
Groundwater	Groundwater	Area 2 - Industrial	NA				
			(Total)	0E+00	0E+00	0E+00	0E+00
			Total Risk Across All Media and All Exposure Routes				7E-06

Medium	Exposure Medium	Exposure Point	Chemical	Primary Target Organ	Non-Carcinogenic Hazard Quotient: Ingestion	Non-Carcinogenic Hazard Quotient: Inhalation	Non-Carcinogenic Hazard Quotient: Dermal	Non-Carcinogenic Hazard Quotient: Exposure Routes Total
Soil	Surface Soil	Area 2 - Industrial	Arsenic	Skin	0.041	--	0.0026	0.04
			Chromium	NOAEL (GI)[2]	0.00079	0.000053	--	0.0008
			Iron		--	--	--	--
			Manganese	NOAEL (Nervous system)[1]	0.004	0.002	--	0.006
			C9-C12 Aliphatics	Nervous system	0.000031	0.0000000032	0.000012	0.00004
			C9-C10 Aromatics	Kidney	0.00045	0.000000077	0.00017	0.0006
			C9-C18 Aliphatics	Nervous system	0.00045	0.000000046	0.00017	0.0006
			C19-C36 Aliphatics	Liver	0.00056	--	0.00021	0.0008
			C11-C22 Aromatics	Kidney	0.035	0.000005	0.013	0.05
			(Total)		0.08	0.002	0.02	0.1
Groundwater	Groundwater	Area 2 - Industrial	Aluminum	NOAEL	0.002	NA	NA	0.0
			Manganese	NOAEL (Nervous system)[1]	0.072	NA	NA	0.07
			(Total)		0.07	0.0	0.0	0.07
			Total Hazard Index Across All Media and All Exposure Routes					0.2
							Total [Skin] HI =	0.04
							Total [GI] HI =	0.0008
							Total [Nervous system] HI =	0.08
							Total [Liver] HI =	0.0008
							Total [Kidney] HI =	0.05
							Total [NOAEL] HI =	0.08

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 3
RISK ASSESSMENT SUMMARY
AREA 2 - INDUSTRIAL - CONSTRUCTION WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Construction worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Industrial	Arsenic	2E-06	4E-10	2E-07	2E-06	Arsenic	Skin	0.33	--	0.031	0.4
			Chromium	NA	2E-09	NA	2E-09	Chromium	NOAEL (GI)[2]	0.0063	0.00018	--	0.006
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.032	0.0067	--	0.04
								C9-C12 Aliphatics	Nervous system	0.000025	0.0000000011	0.000014	0.00004
								C9-C10 Aromatics	Kidney	0.00036	0.000000026	0.00021	0.0006
								C9-C18 Aliphatics	Nervous system	0.00036	0.000000016	0.0002	0.0006
								C19-C36 Aliphatics	Liver	0.00044	--	0.00025	0.0007
								C11-C22 Aromatics	Kidney	0.028	0.0000017	0.016	0.04
			(Total)	2E-06	2E-09	2E-07	2E-06	(Total)		0.4	0.007	0.05	0.5
	Subsurface Soil	Area 2 - Industrial	Arsenic	5E-07	2E-10	5E-08	6E-07	Arsenic	Skin	0.15	--	0.015	0.2
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.015	0.0032	--	0.02
								C9-C12 Aliphatics	Nervous system	0.0000045	0.000000002	0.0000003	0.0000007
								C9-C10 Aromatics	Kidney	0.0000064	0.000000005	0.0000037	0.00001
								C9-C18 Aliphatics	Nervous system	0.0000064	0.000000003	0.0000036	0.00001
								C19-C36 Aliphatics	Liver	0.0000079	--	0.0000044	0.00001
								C11-C22 Aromatics	Kidney	0.00049	0.00000003	0.00025	0.0007
			(Total)	5E-07	2E-10	5E-08	6E-07	(Total)		0.2	0.003	0.02	0.2
			Total Risk Across All Media and All Exposure Routes				3E-06	Total Hazard Index Across All Media and All Exposure Routes					0.6
												Total [Skin] HI =	0.5
												Total [GI] HI =	0.006
												Total [Nervous system] HI =	0.06
												Total [Liver] HI =	0.0007
												Total [Kidney] HI =	0.05
												Total [NOAEL] HI =	0.06

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

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TABLE 4
RISK ASSESSMENT SUMMARY
AREA 2 - INDUSTRIAL - ADULT RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Industrial	Arsenic	6E-06	2E-09	9E-07	7E-06	Arsenic	Skin	0.041	--	0.0059	0.05
			Chromium	NA	8E-09	NA	8E-09	Chromium	NOAEL (GI)[2]	0.0053	0.000021	--	0.0053
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.004	0.00077	--	0.005
								C9-C12 Aliphatics	Nervous system	0.000031	0.0000000013	0.000027	0.00006
								C9-C10 Aromatics	Kidney	0.00045	0.00000003	0.00039	0.0008
								C9-C18 Aliphatics	Nervous system	0.00045	0.000000018	0.00039	0.0008
								C19-C36 Aliphatics	Liver	0.00056	--	0.00048	0.0010
								C11-C22 Aromatics	Kidney	0.035	0.000002	0.03	0.07
			(Total)	6E-06	1E-08	9E-07	7E-06	(Total)		0.09	0.0008	0.04	0.1
	Subsurface Soil	Area 2 - Industrial	Arsenic	3E-06	1E-09	4E-07	3E-06	Arsenic	Skin	0.019	--	0.0028	0.02
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.0019	0.00037	--	0.002
								C9-C12 Aliphatics	Nervous system	0.00000056	0.00000000002	0.0000005	0.000001
								C9-C10 Aromatics	Kidney	0.000008	0.0000000005	0.000007	0.00002
								C9-C18 Aliphatics	Nervous system	0.000008	0.0000000003	0.0000069	0.00001
								C19-C36 Aliphatics	Liver	0.0000099	--	0.0000085	0.00002
								C11-C22 Aromatics	Kidney	0.00061	0.000000035	0.00053	0.001
			(Total)	3E-06	1E-09	4E-07	3E-06	(Total)		0.02	0.0004	0.003	0.03
Groundwater	Groundwater	Area 2 - Industrial	NA					Aluminum	NOAEL	0.0056	NA	NA	0.0
								Manganese	NOAEL (Nervous system)[1]	0.2	NA	NA	0.2
			(Total)	0E+00	0E+00	0E+00	0E+00	(Total)		0.2	0.0	0.0	0.2
			Total Risk Across All Media and All Exposure Routes				1E-05	Total Hazard Index Across All Media and All Exposure Routes					0.4
												Total [Skin] HI =	0.07
												Total [GI] HI =	0.005
												Total [Nervous system] HI =	0.2
												Total [Liver] HI =	0.001
												Total [Kidney] HI =	0.07
												Total [NOAEL] HI =	0.2

Notes:

1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.

2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.

Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.

NA - No toxicity data

NOAEL - No observable adverse effect level

HQ - Hazard quotient

HI - Hazard index

-- = No toxicity data

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TABLE 5
RISK ASSESSMENT SUMMARY
AREA 2 - INDUSTRIAL - CHILD RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Industrial	Arsenic	1E-05	1E-09	5E-06	2E-05
			Chromium	NA	5E-09	NA	5E-09
			(Total)	1E-05	6E-09	5E-06	2E-05
	Subsurface Soil	Area 2 - Industrial	Arsenic	7E-06	6E-10	2E-06	9E-06
			(Total)	7E-06	6E-10	2E-06	9E-06
			Total Risk Across All Media and All Exposure Routes				2E-05

Medium	Exposure Medium	Exposure Point	Chemical	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Industrial	Arsenic	Skin	0.38	--	0.12	0.5
			Chromium	NOAEL (GI)[2]	0.049	0.000048	--	0.05
			Iron		--	--	--	--
			Manganese	NOAEL (Nervous system)[1]	0.037	0.0018	--	0.04
			C9-C12 Aliphatics	Nervous system	0.00029	0.0000000029	0.00055	0.0008
			C9-C10 Aromatics	Kidney	0.0042	0.00000007	0.0081	0.01
			C9-C18 Aliphatics	Nervous system	0.0042	0.000000042	0.0081	0.01
			C19-C36 Aliphatics	Liver	0.0052	--	0.0098	0.02
			C11-C22 Aromatics	Kidney	0.32	0.0000046	0.62	0.9
			(Total)		0.8	0.002	0.8	2
	Subsurface Soil	Area 2 - Industrial	Arsenic	Skin	0.18	--	0.057	0.2
			Iron		--	--	--	--
			Manganese	NOAEL (Nervous system)[1]	0.018	0.00085	--	0.02
			C9-C12 Aliphatics	Nervous system	0.0000052	0.00000000005	0.0000099	0.00002
			C9-C10 Aromatics	Kidney	0.000075	0.0000000012	0.00014	0.0002
			C9-C18 Aliphatics	Nervous system	0.000075	0.0000000007	0.00014	0.0002
			C19-C36 Aliphatics	Liver	0.000092	--	0.00017	0.0003
			C11-C22 Aromatics	Kidney	0.0057	0.00000008	0.011	0.02
			(Total)		0.2	0.0009	0.07	0.3
			Total Hazard Index Across All Media and All Exposure Routes					2

Total [Skin] HI =	0.7
Total [GI] HI =	0.05
Total [Nervous system] HI =	0.07
Total [Liver] HI =	0.02
Total [Kidney] HI =	1
Total [NOAEL] HI =	0.1

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

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TABLE 6
RISK ASSESSMENT SUMMARY
AREA 2 - RECREATIONAL - RECREATIONAL VISITOR
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Current/Future
Receptor Population: Recreational visitor
Receptor Age: Child (ages 6 through 16)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Recreational	Arsenic	4E-06	NA	5E-06	9E-06	Arsenic	Skin	0.06	NA	0.072	0.1
			Aroclor-1260	4E-07	NA	3E-06	3E-06	Aroclor-1260	Immune system	0.067	NA	0.45	0.5
								Iron		--	NA	--	--
								Manganese	NOAEL (Nervous system)[1]	0.0014	NA	--	0.001
								C9-C12 Aliphatics	Nervous system	0.000013	NA	0.000094	0.0001
								C9-C10 Aromatics	Kidney	0.00021	NA	0.0015	0.002
								C9-C18 Aliphatics	Nervous system	0.00019	NA	0.0013	0.001
								C19-C36 Aliphatics	Liver	0.00023	NA	0.0016	0.002
								C11-C22 Aromatics	Kidney	0.014	NA	0.1	0.1
			(Total)	4E-06	0E+00	8E-06	1E-05	(Total)		0.1	0.0	0.6	0.8
Sediment	Sediment	Area 2 - Recreational	Arsenic	5E-06	NA	2E-05	3E-05	Aluminum	NOAEL	0.0015	NA	--	0.002
			Lead	--	NA	--	0E+00	Arsenic	Skin	0.069	NA	0.33	0.4
			Dieldrin	1E-08	NA	--	1E-08	Chromium	NOAEL (GI)[2]	0.0015	NA	--	0.002
								Iron		--	NA	--	0.000
								Lead		--	NA	--	0.000
								Manganese	NOAEL (Nervous system)[1]	0.052	NA	--	0.05
								Dieldrin	Liver	0.000086	NA	--	0.00009
								TPH	Kidney	0.01	NA	0.29	0.3
			(Total)	5E-06	0E+00	2E-05	3E-05	(Total)		0.07	0.0	0.6	0.4
Surface water	Surface water	Area 2 - Recreational	Arsenic	4E-06	NA	9E-07	5E-06	Aluminum	NOAEL	0.0015	NA	--	0.002
			Lead	--	NA	--	0E+00	Arsenic	Skin	0.064	NA	0.013	0.08
			BEHP	5E-09	NA	--	5E-09	Barium	Cardiovascular	0.00077	NA	0.0021	0.003
			Chloroform	7E-11	NA	--	7E-11	Cadmium	Kidney	0.0049	NA	0.019	0.02
			PCE	2E-09	NA	--	2E-09	Chromium	NOAEL (GI)[2]	0.0012	NA	0.0091	0.01
			TCE	6E-10	NA	--	6E-10	Copper		--	NA	--	0.0
								Iron		--	NA	--	0.0
								Lead		--	NA	--	0.0
								Manganese	NOAEL (Nervous system)[1]	0.0018	NA	0.0058	0.008
								Vanadium	NOAEL	0.001	NA	0.0075	0.009
								BEHP	Liver	0.00012	NA	--	0.0001
								1,2-DCE	Liver	0.00028	NA	--	0.0003
								Chloroform	Liver	0.0000076	NA	--	0.000008
								PCE	Liver	0.000025	NA	--	0.00003
								TCE	Liver	0.000057	NA	--	0.00006
								C10-C22 Aromatics	Kidney	0.0045	NA	--	0.005
								C19-C36 Aliphatics	Liver	0.000028	NA	--	0.00003
			(Total)	4E-06	0E+00	9E-07	5E-06	(Total)		0.07	0.0	0.06	0.1
Total Risk Across All Media and All Exposure Routes							2E-05	Total Hazard Index Across All Media and All Exposure Routes					1
								Total [Skin] HI =					0.6
								Total [GI] HI =					0.01
								Total [Nervous system] HI =					0.06
								Total [Liver] HI =					0.002
								Total [Kidney] HI =					0.4
								Total [Cardiovascular] HI =					0.003
								Total [immune system] HI =					0.5
								Total [NOAEL] HI =					0.08

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased likelihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data
BEHP - bis(2-ethylhexyl)phthalate
1,2-DCE - 1,2-Dichloroethene
TCE - Trichloroethene
PCE - Tetrachloroethene
TPH - Total petroleum hydrocarbons

TABLE 7
RISK ASSESSMENT SUMMARY
AREA 2 - RECREATIONAL - CONSTRUCTION WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Construction worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Recreational	Arsenic	2E-06	1E-09	2E-07	2E-06
			Aroclor-1260	2E-07	1E-11	1E-07	3E-07
			(Total)	2E-06	1E-09	3E-07	3E-06
	Subsurface Soil	Area 2 - Recreational	Arsenic	1E-06	4E-10	1E-07	1E-06
			Lead	--	--	--	0E+00
			Dieldrin	6E-09	2E-13	--	6E-09
			Aroclor-1260	8E-07	3E-11	4E-07	1E-06
			Aroclor-1248	3E-08	1E-12	2E-08	5E-08
			Chromium	NA	1E-07	NA	1E-07
			(Total)	2E-06	1E-07	5E-07	2E-06
			Total Risk Across All Media and All Exposure Routes				5E-06

Medium	Exposure Medium	Exposure Point	Chemical	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Recreational	Arsenic	Skin	0.75	--	0.071	0.8
			Aroclor-1260	Immune system	0.34	--	0.18	0.5
			Iron		--	--	--	--
			Manganese	NOAEL (Nervous system)[1]	0.018	0.0038	--	0.02
			C9-C12 Aliphatics	Nervous system	0.000016	0.0000000007	0.0000092	0.00003
			C9-C10 Aromatics	Kidney	0.00027	0.00000002	0.00015	0.0004
			C9-C18 Aliphatics	Nervous system	0.00023	0.00000001	0.00013	0.0004
			C19-C36 Aliphatics	Liver	0.00028	--	0.00016	0.0004
			C11-C22 Aromatics	Kidney	0.018	0.0000011	0.01	0.03
			(Total)		1	0.004	0.3	1
	Subsurface Soil	Area 2 - Recreational	Arsenic	Skin	0.33	--	0.031	0.4
			Iron		--	--	--	--
			Manganese	NOAEL (Nervous system)[1]	0.011	0.0024	--	0.01
			Aluminum	NOAEL	0.033	--	--	0.03
			Chromium	NOAEL (GI)[2]	0.57	0.016	--	0.6
			Lead		--	--	--	0.0
			Dieldrin	Liver	0.0011	--	--	0.001
			Aroclor-1260	Immune system	1.1	--	0.6	2
			Aroclor-1248	Immune system	0.045	--	0.024	0.07
			C9-C12 Aliphatics	Nervous system	0.0001	0.000000004	0.0000570	0.0002
			C9-C10 Aromatics	Kidney	0.0015	0.0000001	0.00083	0.002
			C9-C18 Aliphatics	Nervous system	0.0015	0.00000006	0.00082	0.002
			C19-C36 Aliphatics	Liver	0.0018	--	0.001	0.003
			C11-C22 Aromatics	Kidney	0.11	0.000007	0.063	0.2
			(Total)		2	0.02	0.7	2.9
			Total Hazard Index Across All Media and All Exposure Routes					4

Total [Skin] HI =	1
Total [GI] HI =	0.6
Total [Nervous system] HI =	0.04
Total [Liver] HI =	0.004
Total [Kidney] HI =	0.2
Total [Immune system] HI =	2
Total [NOAEL] HI =	0.7

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 8
RISK ASSESSMENT SUMMARY
AREA 2 - RECREATIONAL - ADULT RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Recreational	Arsenic	1E-05	5E-09	2E-06	1E-05	Arsenic	Skin	0.094	--	0.013	0.1
			Aroclor-1260	1E-06	5E-11	1E-06	2E-06	Aroclor-1260	Immune system	0.11	--	0.086	0.2
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.0023	0.00044	--	0.003
								C9-C12 Aliphatics	Nervous system	0.000021	0.0000000008	0.000018	0.00004
								C9-C10 Aromatics	Kidney	0.00033	0.000000022	0.00029	0.0006
								C9-C18 Aliphatics	Nervous system	0.00029	0.000000012	0.00025	0.0005
								C19-C36 Aliphatics	Liver	0.00036	--	0.00031	0.0007
								C11-C22 Aromatics	Kidney	0.022	0.0000013	0.019	0.04
			(Total)	1E-05	5E-09	3E-06	1E-05	(Total)		0.2	0.0004	0.1	0.3
	Subsurface Soil	Area 2 - Recreational	Arsenic	6E-06	2E-09	9E-07	7E-06	Arsenic	Skin	0.041	--	0.0059	0.05
			Lead	--	--	--	0E+00	Iron		--	--	--	--
			Dieldrin	4E-08	1E-12	--	4E-08	Manganese	NOAEL (Nervous system)[1]	0.0014	0.00027	--	0.002
			Aroclor-1260	5E-06	2E-10	4E-06	9E-06	Aluminum	NOAEL	0.004	--	--	0.004
			Aroclor-1248	2E-07	7E-12	2E-07	4E-07	Chromium	NOAEL (GI)[2]	0.47	0.0019	--	0.5
			Chromium	NA	8E-07	NA	8E-07	Lead		--	--	--	0.0
								Dieldrin	Liver	0.0013	--	--	0.001
								Aroclor-1260	Immune system	0.35	--	0.29	1
								Aroclor-1248	Immune system	0.014	--	0.011	0.03
								C9-C12 Aliphatics	Nervous system	0.00013	0.000000005	0.00011	0.0002
								C9-C10 Aromatics	Kidney	0.0018	0.0000001	0.0016	0.003
								C9-C18 Aliphatics	Nervous system	0.0018	0.00000007	0.0016	0.003
								C19-C36 Aliphatics	Liver	0.0022	--	0.0019	0.004
								C11-C22 Aromatics	Kidney	0.14	0.000008	0.12	0.3
			(Total)	1E-05	8E-07	5E-06	2E-05	(Total)		1	0.002	0.4	1
Groundwater	Groundwater	Area 2 - Recreational	Arsenic	9E-04	NA	NA	9E-04	Arsenic	Skin	5	NA	NA	[illegible]
			Aroclor-1260	5E-06	NA	NA	5E-06	Aroclor-1260	Immune system	0.3	NA	NA	0.3
			BEHP	7E-05	NA	NA	7E-05	BEHP	Liver	0.55	NA	NA	0.6
			PCE	1E-05	NA	NA	1E-05	PCE	Liver	0.04	NA	NA	0.04
			TCE	2E-07	NA	NA	2E-07	TCE	Liver	0.0087	NA	NA	0.009
								1,2-DCE	Liver	0.04	NA	NA	0.04
								Manganese	NOAEL (Nervous system)[1]	0.83	NA	NA	0.8
			(Total)	1E-03	0E+00	0E+00	1E-03	(Total)		7	0.0	0.0	7
			Total Risk Across All Media and All Exposure Routes				1E-03	Total Hazard Index Across All Media and All Exposure Routes					8

Total [Skin] HI =	[illegible]
Total [GI] HI =	0.5
Total [Nervous system] HI =	0.8
Total [Liver] HI =	0.6
Total [Kidney] HI =	0.3
Total [Immune system] HI =	1
Total [NOAEL] HI =	1

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range (1×10^{-6} to 1×10^{-4})
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data
BEHP - bis(2-ethylhexyl)phthalate
1,2-DCE - 1,2-Dichloroethene
TCE - Trichloroethene
PCE - Tetrachloroethene

TABLE 9
RISK ASSESSMENT SUMMARY
AREA 2 - RECREATIONAL - CHILD RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Recreational	Arsenic	3E-05	3E-09	1E-05	4E-05
			Aroclor-1260	3E-06	3E-11	6E-06	9E-06
			(Total)	3E-05	3E-09	2E-05	5E-05
	Subsurface Soil	Area 2 - Recreational	Arsenic	1E-05	1E-09	5E-06	2E-05
			Lead	--	--	--	0E+00
			Dieldrin	8E-08	8E-13	--	8E-08
			Aroclor-1260	1E-05	1E-10	2E-05	3E-05
			Aroclor-1248	4E-07	4E-12	8E-07	1E-06
			Chromium	NA	4E-07	NA	4E-07
			(Total)	2E-05	4E-07	3E-05	5E-05
			Total Risk Across All Media and All Exposure Routes				1E-04

Medium	Exposure Medium	Exposure Point	Chemical	Non-Carcinogenic Hazard Quotient				
				Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 2 - Recreational	Arsenic	Skin	0.87	--	0.28	1
			Aroclor-1260	Immune system	0.99	--	1.8	3
			Iron		--	--	--	--
			Manganese	NOAEL (Nervous system)[1]	0.021	0.001	--	0.02
			C9-C12 Aliphatics	Nervous system	0.00019	0.000000002	0.00036	0.0006
			C9-C10 Aromatics	Kidney	0.0031	0.000000051	0.006	0.009
			C9-C18 Aliphatics	Nervous system	0.0027	0.000000027	0.0052	0.008
			C19-C36 Aliphatics	Liver	0.0033	--	0.0063	0.01
			C11-C22 Aromatics	Kidney	0.21	0.0000029	0.4	0.6
			(Total)		2	0.001	2	5
	Subsurface Soil	Area 2 - Recreational	Arsenic	Skin	0.38	--	0.12	0.5
			Iron		--	--	--	--
			Manganese	NOAEL (Nervous system)[1]	0.013	0.00062	--	0.01
			Aluminum	NOAEL	0.026	--	--	0.03
			Chromium	NOAEL (GI)[2]	4.4	0.0043	--	4
			Lead		--	--	--	0.0
			Dieldrin	Liver	0.0012	--	--	0.001
			Aroclor-1260	Immune system	3.3	--	5.9	9
			Aroclor-1248	Immune system	0.13	--	0.24	0.4
			C9-C12 Aliphatics	Nervous system	0.0012	0.000000012	0.00230	0.004
			C9-C10 Aromatics	Kidney	0.017	0.0000003	0.033	0.05
			C9-C18 Aliphatics	Nervous system	0.017	0.00000017	0.032	0.05
			C19-C36 Aliphatics	Liver	0.021	--	0.039	0.06
			C11-C22 Aromatics	Kidney	1.3	0.000018	2.5	4
			(Total)		10	0.005	9	18
			Total Hazard Index Across All Media and All Exposure Routes					23
							Total [Skin] HI =	2
							Total [GI] HI =	4
							Total [Nervous system] HI =	0.1
							Total [Liver] HI =	0.1
							Total [Kidney] HI =	4
							Total [Immune system] HI =	12
							Total [NOAEL] HI =	4

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 10
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - MAINTENANCE WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Current/Future
Receptor Population: Maintenance worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 3 - Industrial	Arsenic	5E-06	4E-09	4E-07	5E-06	Arsenic	Skin	0.028	--	0.0024	0.03
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.0016	0.00077	--	0.002
								C9-C12 Aliphatics	Nervous system	0.0000054	0.0000000006	0.0000028	0.00001
								C9-C10 Aromatics	Kidney	0.000033	0.0000000056	0.000017	0.0001
								C9-C18 Aliphatics	Nervous system	0.0000012	0.0000000001	0.00000064	0.0000
								C19-C36 Aliphatics	Liver	0.0000013	--	0.00000067	0.0000
								C11-C22 Aromatics	Kidney	0.000066	0.0000000096	0.000035	0.00
			(Total)	5E-06	4E-09	4E-07	5E-06	(Total)		0.03	0.0008	0.002	0.03
Total Risk Across All Media and All Exposure Routes							5E-06	Total Hazard Index Across All Media and All Exposure Routes					0.03
												Total [Skin] HI =	0.03
												Total [Nervous system] HI =	0.002
												Total [Liver] HI =	0.000002
												Total [Kidney] HI =	0.0002
												Total [NOAEL] HI =	0.002

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

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TABLE 11
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - COMMERCIAL/INDUSTRIAL WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Commercial/industrial worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 3 - Industrial	Arsenic	1E-05	1E-08	8E-07	1E-05	Arsenic	Skin	0.08	--	0.0051	0.09
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.0045	0.0022	--	0.007
								C9-C12 Aliphatics	Nervous system	0.000016	0.0000000016	0.0000059	0.00002
								C9-C10 Aromatics	Kidney	0.000095	0.000000016	0.000037	0.0001
								C9-C18 Aliphatics	Nervous system	0.0000036	0.0000000004	0.0000013	0.000005
								C19-C36 Aliphatics	Liver	0.0000037	--	0.0000014	0.000005
								C11-C22 Aromatics	Kidney	0.00019	0.000000027	0.000073	0.0003
			(Total)	1E-05	1E-08	8E-07	1E-05	(Total)		0.08	0.002	0.01	0.09
Groundwater	Groundwater	Area 3 - Industrial	Arsenic	2E-04	NA	NA	2E-04	Aluminum	NOAEL	0.0019	NA	NA	0.002
			1,4-Dichlorobenzene	5E-07	NA	NA	5E-07	Arsenic	Skin	1.1	NA	NA	1
			Naphthalene	--	NA	NA	0E+00	Cadmium	Kidney	0.17	NA	NA	0.2
			Carbon Tetrachloride	2E-06	NA	NA	2E-06	Iron		--	NA	NA	0
			Chloroform	2E-07	NA	NA	2E-07	Manganese	NOAEL (Nervous system)[1]	0.19	NA	NA	0.2
			Tetrachloroethene	5E-07	NA	NA	5E-07	1,2-Dichlorobenzene	NOAEL	0.0011	NA	NA	0.001
								1,4-Dichlorobenzene	NOAEL	0.0018	NA	NA	0.002
								Naphthalene	Liver	0.0098	NA	NA	0.01
								Carbon Tetrachloride	Liver	0.063	NA	NA	0.06
								Chloroform	Liver	0.0098	NA	NA	0.01
								Tetrachloroethene	Liver	0.0025	NA	NA	0.003
								C9-C10 Aromatics	Kidney	0.1	NA	NA	0.1
			(Total)	2E-04	0E+00	0E+00	2E-04	(Total)		2	0.0	0.0	2
			Total Risk Across All Media and All Exposure Routes				2E-04	Total Hazard Index Across All Media and All Exposure Routes					2

Total [Skin] HI =	1
Total [Nervous system] HI =	0.2
Total [Liver] HI =	0.09
Total [Kidney] HI =	0.3
Total [NOAEL] HI =	0.01

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 12
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - CONSTRUCTION WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Construction worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 3 - Industrial	Arsenic	2E-06	9E-10	2E-07	2E-06	Arsenic	Skin	0.64	--	0.06	0.7
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.036	0.0077	--	0.04
								C9-C12 Aliphatics	Nervous system	0.000013	0.0000000006	0.000007	0.00002
								C9-C10 Aromatics	Kidney	0.000076	0.0000000056	0.000044	0.0001
								C9-C18 Aliphatics	Nervous system	0.0000028	0.0000000001	0.0000016	0.000004
								C19-C36 Aliphatics	Liver	0.000003	--	0.0000017	0.000005
								C11-C22 Aromatics	Kidney	0.00015	0.0000000095	0.000087	0.0002
			(Total)	2E-06	9E-10	2E-07	2E-06	(Total)		0.7	0.008	0.06	0.7
	Subsurface Soil	Area 3 - Industrial	Arsenic	5E-07	2E-10	5E-08	5E-07	Arsenic	Skin	0.15	--	0.014	0.2
								Iron		--	--	--	--
								C9-C12 Aliphatics	Nervous system	0.00000066	0.00000000003	0.0000004	0.000001
								C9-C10 Aromatics	Kidney	0.0000055	0.0000000004	0.0000031	0.000009
								C9-C18 Aliphatics	Nervous system	0.000061	0.000000003	0.000034	0.0001
								C19-C36 Aliphatics	Liver	0.000077	0.00000011	0.000044	0.0001
								C11-C22 Aromatics	Kidney	0.0017	0.00000003	0.00099	0.003
			(Total)	5E-07	2E-10	5E-08	5E-07	(Total)		0.2	0.0000001	0.02	0.2
Total Risk Across All Media and All Exposure Routes							3E-06	Total Hazard Index Across All Media and All Exposure Routes					0.9
												Total [Skin] HI =	0.9
												Total [Nervous system] HI =	0.04
												Total [Liver] HI =	0.0001
												Total [Kidney] HI =	0.003
												Total [NOAEL] HI =	0.04

Notes:

1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.

2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.

Shaded value indicates a target organ-specific hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.

NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

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TABLE 13
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - ADULT RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 3 - Industrial	Arsenic	1E-05	5E-09	2E-06	1E-05	Arsenic	Skin	0.08	--	0.012	0.09
								Iron		--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.0045	0.00088	--	0.005
								C9-C12 Aliphatics	Nervous system	0.000016	0.0000000006	0.000013	0.00003
								C9-C10 Aromatics	Kidney	0.000095	0.0000000064	0.000083	0.0002
								C9-C18 Aliphatics	Nervous system	0.0000036	0.0000000001	0.0000031	0.00001
								C19-C36 Aliphatics	Liver	0.0000037	--	0.0000032	0.00001
								C11-C22 Aromatics	Kidney	0.00019	0.000000011	0.00017	0.000
			(Total)	1E-05	5E-09	2E-06	1E-05	(Total)		0.08	0.0009	0.01	0.1
	Subsurface Soil	Area 3 - Industrial	Arsenic	3E-06	1E-09	4E-07	3E-06	Arsenic	Skin	0.019	--	0.0027	0.02
								Iron		--	--	--	0.0
								C9-C12 Aliphatics	Nervous system	0.00000082	0.00000000003	0.0000007	0.000002
								C9-C10 Aromatics	Kidney	0.0000068	0.0000000005	0.000006	0.00001
								C9-C18 Aliphatics	Nervous system	0.000076	0.0000000031	0.000066	0.0001
								C19-C36 Aliphatics	Liver	0.000097	--	0.000083	0.0002
								C11-C22 Aromatics	Kidney	0.0022	0.0000001200	0.0019	0.004
			(Total)	3E-06	1E-09	4E-07	3E-06	(Total)		0.02	0.0000001	0.005	0.03
Groundwater	Groundwater	Area 3 - Industrial	Arsenic	6E-04			6E-04	Aluminum	NOAEL	0.0052	NA	NA	0.005
			1,4-Dichlorobenzene	2E-06			2E-06	Arsenic	Skin	3	NA	NA	3
			Naphthalene	--			0E+00	Cadmium	Kidney	0.48	NA	NA	0.5
			Carbon Tetrachloride	7E-06			7E-06	Iron		--	NA	NA	--
			Chloroform	7E-07			7E-07	Manganese	NOAEL (Nervous system)[1]	0.53	NA	NA	0.5
			Tetrachloride	2E-06			2E-06	1,2-Dichlorobenzene	NOAEL	0.003	NA	NA	0.003
								1,4-Dichlorobenzene	NOAEL	0.0051	NA	NA	0.005
								Naphthalene	Liver	0.027	NA	NA	0.03
								Carbon Tetrachloride	Liver	0.18	NA	NA	0.2
								Chloroform	Liver	0.027	NA	NA	0.03
								Tetrachloroethane	Liver	0.0071	NA	NA	0.007
								C9-C10 Aromatics	Kidney	0.28	NA	NA	0.28
			(Total)	6E-04	0E+00	0E+00	6E-04	(Total)		5	0.0	0.0	5
			Total Risk Across All Media and All Exposure Routes				6E-04	Total Hazard Index Across All Media and All Exposure Routes					5

Total [Skin] HI =	3
Total [Nervous system] HI =	0.5
Total [Liver] HI =	0.2
Total [Kidney] HI =	0.8
Total [NOAEL] HI =	0.5

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

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TABLE 14
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - CHILD RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 3 - Industrial	Arsenic	3E-05	3E-09	1E-05	4E-05	Arsenic	Skin	0.75	--	0.24	1
								Iron	--	--	--	--	--
								Manganese	NOAEL (Nervous system)[1]	0.042	0.002	--	0.04
								C9-C12 Aliphatics	Nervous system	0.00015	0.0000000014	0.00028	0.0004
								C9-C10 Aromatics	Kidney	0.00089	0.000000015	0.0017	0.003
								C9-C18 Aliphatics	Nervous system	0.000033	0.0000000003	0.000063	0.0001
								C19-C36 Aliphatics	Liver	0.000035	--	0.000066	0.0001
								C11-C22 Aromatics	Kidney	0.0018	0.000000025	0.0034	0.005
			(Total)	3E-05	3E-09	1E-05	4E-05	(Total)		0.8	0.002	0.2	1
	Subsurface Soil	Area 3 - Industrial	Arsenic	7E-06	6E-10	2E-06	9E-06	Arsenic	Skin	0.18	--	0.056	0.2
								Iron	--	--	--	--	--
								C9-C12 Aliphatics	Nervous system	0.0000077	0.00000000008	0.0000150	0.00002
								C9-C10 Aromatics	Kidney	0.000064	0.0000000001	0.00012	0.0002
								C9-C18 Aliphatics	Nervous system	0.00071	0.0000000070	0.0014	0.0021
								C19-C36 Aliphatics	Liver	0.0009	--	0.0017	0.0026
								C11-C22 Aromatics	Kidney	0.02	0.00000028	0.039	0.06
			(Total)	7E-06	6E-10	2E-06	9E-06	(Total)		0.2	0.0000003	0.1	0.3
Total Risk Across All Media and All Exposure Routes							5E-05	Total Hazard Index Across All Media and All Exposure Routes					1
								Total [Skin] HI =					1
								Total [Nervous system] HI =					0.05
								Total [Liver] HI =					0.003
								Total [Kidney] HI =					0.1
								Total [NOAEL] HI =					0.04

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 15
RISK ASSESSMENT SUMMARY
AREA 3 - RECREATIONAL - RECREATIONAL VISITOR
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Current/Future
Receptor Population: Recreational visitor
Receptor Age: Child (ages 6 through 16)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 3 - Recreational	Arsenic	2E-06	NA	3E-06	5E-06	Arsenic	Skin	0.035	NA	0.042	0.1
			Dieldrin	1E-07	NA	--	1E-07	Dieldrin	Liver	0.001	NA	--	0.001
								Manganese	NOAEL (Nervous system)[1]	0.0009	NA	--	0.0009
								C9-C12 Aliphatics	Nervous system	0.00094	NA	0.0067	0.008
								C9-C10 Aromatics	Kidney	0.0075	NA	0.055	0.06
								C9-C18 Aliphatics	Nervous system	0.00081	NA	0.0058	0.007
								C19-C36 Aliphatics	Liver	0.0012	NA	0.0089	0.01
								C11-C22 Aromatics	Kidney	0.039	NA	0.28	0.3
			(Total)	2E-06	0E+00	3E-06	5E-06	(Total)		0.1	0.0	0.4	0.5
Sediment	Sediment	Area 3 - Recreational	Arsenic	8E-07	NA	4E-06	5E-06	Arsenic	Skin	0.012	NA	0.055	0.07
			Aroclor-1260	2E-08	NA	7E-07	7E-07	Aroclor-1260	Immune system	0.0039	NA	0.11	0.1
								Manganese	NOAEL (Nervous system)[1]	0.00061	NA	--	0.0006
								C9-C12 Aliphatics	Nervous system	0.00000087	NA	0.000025	0.00003
								C9-C10 Aromatics	Kidney	0.000013	NA	0.00039	0.0004
								C5-C8 Aliphatics	Nervous system	0.0000052	NA	0.00015	0.0002
								C19-C36 Aliphatics	Liver	0.0000098	NA	0.00028	0.0003
								C11-C22 Aromatics	Kidney	0.00087	NA	0.025	0.03
			(Total)	8E-07	0E+00	5E-06	6E-06	(Total)		0.02	0.0	0.2	0.2
Surface water	Surface water	Area 3 - Recreational	Arsenic	3E-06	NA	7E-07	4E-06	Antimony	NOAEL	0.0014	NA	0.0018	0.003
			Benzo(k)fluoranthene)	1E-09	NA	3E-07	3E-07	Arsenic	Skin	0.05	NA	0.01	0.06
								Barium	Cardiovascular	0.00039	NA	0.0011	0.001
								Manganese	NOAEL (Nervous system)[1]	0.00038	NA	0.0012	0.002
								Benzo(k)fluoranthene	NOAEL	--	NA	--	0
								C11-C22 Aromatics	Kidney	0.0021	NA	--	0.002
								C19-C36 Aliphatics	Liver	0.000018	NA	--	0.00002
								C9-C10 Aromatics	Kidney	0.000081	NA	--	0.00008
			(Total)	3E-06	0E+00	1E-06	4E-06	(Total)		0.05	0.0	0.01	0.1
			Total Risk Across All Media and All Exposure Routes				1E-05	Total Hazard Index Across All Media and All Exposure Routes					0.7

Total [Skin] HI =	0.3
Total [Nervous system] HI =	0.02
Total [Liver] HI =	0.01
Total [Kidney] HI =	0.4
Total [Cardiovascular] HI =	0.001
Total [Immune system] HI =	0.1
Total [NOAEL] HI =	0.01

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

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TABLE 16
RISK ASSESSMENT SUMMARY
AREA 3 - RECREATIONAL - CONSTRUCTION WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Construction worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 3 - Recreational	Arsenic	1E-06	6E-10	1E-07	1E-06	Arsenic	Skin	0.44	--	0.041	0.5
			Dieldrin	7E-07	3E-12	--	7E-07	Dieldrin	Liver	0.013	--	--	0.0
								Manganese	NOAEL (Nervous system)[1]	0.011	0.0024	--	0.01
								C9-C12 Aliphatics	Nervous system	0.0012	0.000000051	0.00066	0.00186
								C9-C10 Aromatics	Kidney	0.0094	0.00000069	0.0054	0.0148
								C9-C18 Aliphatics	Nervous system	0.001	0.000000045	0.00057	0.0016
								C19-C36 Aliphatics	Liver	0.0016	--	0.00088	0.0025
								C11-C22 Aromatics	Kidney	0.049	0.000003	0.028	0.08
			(Total)	2E-06	6E-10	1E-07	2E-06	(Total)		1	0.002	0.1	0.6
	Subsurface Soil	Area 3 - Recreational	Arsenic	1E-06	6E-10	1E-07	1E-06	Arsenic	Skin	0.44	--	0.042	0.5
			(Total)	1E-06	6E-10	1E-07	1E-06	(Total)		0.4	0	0.04	0.5
			Total Risk Across All Media and All Exposure Routes				3E-06	Total Hazard Index Across All Media and All Exposure Routes					1

Total [Skin] HI =	1
Total [Nervous system] HI =	0.02
Total [Liver] HI =	0.02
Total [Kidney] HI =	0.1
Total [NOAEL] HI =	0.01

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

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TABLE 17
RISK ASSESSMENT SUMMARY
AREA 3 - RECREATIONAL - ADULT RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 3 - Recreational	Arsenic	8E-06	3E-09	1E-06	9E-06	Arsenic	Skin	0.055	--	0.0079	0.1
			Dieldrin	4E-07	2E-11	--	4E-07	Dieldrin	Liver	0.0016	--	--	0.002
								Manganese	NOAEL (Nervous system)[1]	0.0014	0.00027	--	0.002
								C9-C12 Aliphatics	Nervous system	0.0015	0.000000059	0.0013	0.003
								C9-C10 Aromatics	Kidney	0.012	0.00000079	0.01	0.02
								C9-C18 Aliphatics	Nervous system	0.0013	0.000000051	0.0011	0.002
								C19-C36 Aliphatics	Liver	0.002	--	0.0017	0.004
								C11-C22 Aromatics	Kidney	0.061	0.0000035	0.053	0.1
			(Total)	8E-06	3E-09	1E-06	9E-06	(Total)		0.1	0.0003	0.08	0.2
	Subsurface Soil	Area 3 - Recreational	Arsenic	8E-06	3E-09	1E-06	9E-06	Arsenic	Skin	0.055	--	0.0079	0.06
			(Total)	8E-06	3E-09	1E-06	9E-06	(Total)		0.06	0	0.008	0.06
Groundwater	Groundwater	Area 3 - Recreational	Arsenic	1E-03	NA	NA	1E-03	Arsenic	Skin	7.7	NA	NA	8
			1,4-Dichlorobenzene	8E-07	NA	NA	8E-07	Aluminum	NOAEL	0.067	NA	NA	0.07
			BEHP	8E-06	NA	NA	8E-06	Iron		--	NA	NA	0
			Naphthalene	--	NA	NA	0E+00	1,4-Dichlorobenzene	NOAEL	0.0025	NA	NA	0.003
			PCE	3E-06	NA	NA	3E-06	Naphthalene	Liver	0.018	NA	NA	0.02
			TCE	5E-07	NA	NA	5E-07	BEHP	Liver	0.071	NA	NA	0.07
								PCE	Liver	0.015	NA	NA	0.02
								TCE	Liver	0.017	NA	NA	0.02
								Manganese	NOAEL (Nervous system)[1]	0.39	NA	NA	0.4
								C5-C8 Aliphatics	Nervous system	0.041	NA	NA	0.04
								C9-C12 Aliphatics	Nervous system	0.0019	NA	NA	0.002
								C9-C10 Aromatics	Kidney	0.16	NA	NA	0.2
			(Total)	1E-03	0E+00	0E+00	1E-03	(Total)		8	0	0	8
Total Risk Across All Media and All Exposure Routes							1E-03	Total Hazard Index Across All Media and All Exposure Routes					9
												Total [Skin] HI =	8
												Total [Nervous system] HI =	0.4
												Total [Liver] HI =	0.2
												Total [Kidney] HI =	0.3
												Total [NOAEL] HI =	0.5

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data
BEHP - bis(2-ethylhexyl)phthalate
TCE - Trichloroethene
PCE - Tetrachloroethene

TABLE 18
RISK ASSESSMENT SUMMARY
AREA 3 - RECREATIONAL - CHILD RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Area 3 - Recreational	Arsenic	2E-05	2E-09	6E-06	3E-05	Arsenic	Skin	0.51	--	0.16	0.7
			Dieldrin	1E-06	1E-11	--	1E-06	Dieldrin	Liver	0.015	--	--	0.02
								Manganese	NOAEL (Nervous system)[1]	0.013	0.00063	--	0.01
								C9-C12 Aliphatics	Nervous system	0.014	0.00000014	0.026	0.04
								C9-C10 Aromatics	Kidney	0.11	0.0000018	0.21	0.3
								C9-C18 Aliphatics	Nervous system	0.012	0.00000012	0.023	0.04
								C19-C36 Aliphatics	Liver	0.018	--	0.035	0.05
								C11-C22 Aromatics	Kidney	0.57	0.000008	1.1	2
			(Total)	2E-05	2E-09	6E-06	3E-05	(Total)		1	0.0006	2	3
	Subsurface Soil	Area 3 - Recreational	Arsenic	2E-05	2E-09	6E-06	3E-05	Arsenic	Skin	0.52	--	0.16	0.68
			(Total)	2E-05	2E-09	6E-06	3E-05	(Total)		0.5	0.0	0.2	0.7
			Total Risk Across All Media and All Exposure Routes				5E-05	Total Hazard Index Across All Media and All Exposure Routes					3
												Total [Skin] HI =	1
												Total [Nervous system] HI =	0.1
												Total [Liver] HI =	0.1
												Total [Kidney] HI =	2
												Total [NOAEL] HI =	0.01

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

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ECOLOGICAL RISK ASSESSMENT

O-1 EXPOSURE AND EFFECTS ASSUMPTIONS CPCs

O-2 ECOLOGICAL RISK CALCULATIONS

O-3 ECOLOGICAL RISK CALCULATIONS FOR CPCs SUPPORTING INFORMATION

O-4 ECOLOGICAL RISK CALCULATIONS FOR NON-CPCs SUPPORTING INFORMATION

O-5 STATISTICAL ANALYSIS OF TOXICITY TESTING (MIDGE GROWTH)

O-1 EXPOSURE AND EFFECTS ASSUMPTIONS FOR CPCs

Table O-1.1
Exposure Parameters for Representative Wildlife Species
AOC 57

Remedial Investigation Report
Devens, Massachusetts

Representative Wildlife Species	Body Weight (kg)	Reported Diet	Assumed Diet for Exposure Assessment (% of diet)	Food Ingestion Rate (kg/day)	Water Intake Rate (ℓ /day)	Exposure Duration	Home Range (acres)
White-footed mouse (*Peromyscus leucopus*)	0.040 [a]	Seeds and some insects [a]	88% Plants 10% Invertebrates 2% Soil [a]	0.0049 [b]	0.0055 [c]	1	0.147 [d]
Short-tailed shrew (*Blarina brevicauda*)	0.017 [a]	Earthworms, slugs, snails, fungi, insects, and vegetation [b]	78% Invertebrates 12% Plants 10% Soil [g]	0.0024 [b]	0.0025 [c]	1	0.96 ± 0.09 [a]
Muskrat (*Ondatra zibethicus*)	1.27 [e]	Cattails, reeds, pondweeds, bulrushes, water lillies, fresh-water clams, and other small aquatic animals [f]	80% Plants 10% Invertebrates 10% Sediment [g]	0.084 [b]	0.12 [c]	1	0.20 [h]
American robin (*Turdus migratorius*)	0.077 [i]	Fruits and invertebrates [j].	57% Plants 33% Invertebrates 10% Soil [k]	0.011 [l]	0.011 [m]	0.75 [v]	0.48 [n]
Mallard (*Anas platyrhynchos*)	1.134 [o]	Primarily aquatic plants in winter. Breeding females eat grasses, rice, insects, gastropods, insects, crustaceans, and annelids [a]	97% Plants 1% Invertebrates 2% Sediment [k]	0.063 [l]	0.064 [m]	1	235 [p]
Red fox (*Vulpes vulpes*)	4.69 [q]	Small mammals, birds, and invertebrates, as well as berries and other fruits. [a]	57% Small mammals 20% Invertebrates 10% Small birds 10% Plants 3% Soil [a]	0.24 [b]	0.40 [c]	1	1,727 ± 339 [a]

See notes at end of table

Table O-1.1
Exposure Parameters for Representative Wildlife Species
AOC 57

Remedial Investigation Report
Devens, Massachusetts

Representative Wildlife Species	Body Weight (kg)	Reported Diet	Assumed Diet for Exposure Assessment (% of diet)	Food Ingestion Rate (kg/day)	Water Intake Rate (ℓ /day)	Exposure Duration	Home Range (acres)
Raccoon (*Procyon lotor*)	3.99 [r]	Mostly fleshy fruits, nuts acorns, corn; also frogs, crayfish, and insects [a]	Sediment Exposures: 91% Crayfish and other aquatic invertebrates 9% Sediment [k] Floodplain Exposures: 56% Plants 14% Invertebrates 19% Mammals 2% Birds 9% Soil [k]	0.214 [b]	0.344 [c]	1	385 [s]
Barred owl (*Strix varia*)	0.72 [t]	Mice (staple) and other small mammals, frogs, birds, insects, crayfish, [f]	80% Small mammals 12% Small birds 3% Invertebrates 5% Soil [g]	0.047 [l]	0.047 [m]	1	565 [f]
Great blue heron (*Ardea herodias*)	2.23 ± 0.76 [a]	Mostly fish; some amphibians, crustaceans, and birds [a]	98% Fish and aquatic invertebrates 2% Sediment [g]	0.401 [l]	0.101 [m]	0.5 [v]	1.5 [u]

See notes at end of table

Table O-1.1
Exposure Parameters for Representative Wildlife Species
AOC 57

Remedial Investigation Report
Devens, Massachusetts

Representative Wildlife Species	Body Weight (kg)	Reported Diet	Assumed Diet for Exposure Assessment (% of diet)	Food Ingestion Rate (kg/day)	Water Intake Rate (ℓ/day)	Exposure Duration	Home Range (acres)

References:

[a] Wildlife Exposure Factors Handbook (USEPA, 1993a). Values for the cotton mouse and deer mouse are used for the white-footed mouse when not available. Mean of means reported for male and female shrews in summer and fall.
[b] Calculated using the mammal equation based on body weight (Wt.) in kg. Food ingestion (kg/day) = $0.0687 \times Wt^{0.822}$ (kg) (USEPA, 1993a).
[c] Calculated using the mammal equation based on body weight (Wt.) in kg. Water ingestion (l/day) = $0.099 \times Wt^{0.90}$ (kg) (USEPA, 1993a).
[d] Average for male and female deer mice, Virginia/mixed deciduous forest (USEPA, 1993a).
[e] Average of male and female muskrat body weights during winter in Tennessee (USEPA, 1993a).
[f] DeGraaf & Rudis (1986).
[g] Estimated soil ingestion.
[h] Average of mean home range values for muskrats in early and late summer in Ontario Bay (USEPA, 1993a).
[i] Mean year-round value for male and female robins in Pennsylvania (USEPA, 1993a).
[j] Average year-round values for robins in the eastern United States (USEPA, 1993a).
[k] The sediment ingestion for raccoons and mallards were estimated to be the same as their estimated soil ingestion. The soil ingestion rate for the robin was assumed to be the same as for American woodcocks, which ingest higher percentages of soil because of their relatively high dietary composition of earthworms (USEPA 1993a).
[l] Calculated using the bird equation based on body weight (Wt.) in kg. Food ingestion (kg/day) = $0.0582 \times Wt^{0.651}$ (kg) (USEPA, 1993a).
[m] Calculated using the bird equation based on body weight (Wt.) in kg. Water ingestion (l/day) = $0.059 \times Wt^{0.67}$ (kg) (USEPA, 1993a).
[n] Average of mean home range values provided for robins feeding nestlings and fledglings (USEPA, 1993a).
[o] Average of mean body weights for male and female mallards throughout North America (USEPA, 1993a).
[p] Average of male and female mallard home ranges in Minnesota wetlands and rivers (USEPA, 1993a).
[q] Average of adult male and female foxes in spring (USEPA, 1993a).
[r] Median of mean weights for male and female raccoons in Alabama (USEPA, 1993a).
[s] Average of adult male and female raccoons from May to December (USEPA, 1993a).
[t] Midpoint of average for male and female owls (Terres, 1987).
[u] Size of heron feeding territory in summer (USEPA, 1993a).
[v] The exposure durations for the robin and heron are less than 1 due to decreased foraging capabilities (i.e., robins increase their berry consumption and decrease their earthworm consumption in the winter) and/or migration during winter (i.e., inability of heron to forage in stream during frozen wintertime conditions).

Notes:
g = grams; kg = kilograms; kg/day = kilograms per day; ℓ/day = liters per day; % = percent; NA = not applicable

Table O-1.2
Summary of Bioaccumulation and Bioconcentration Data
AOC 57

Remedial Investigation Report
Devens, Massachusetts

Analyte	log K_{ow} [b]		Bioaccumulation Factor [a]						Bioconcentration Factor [a]
			Terrestrial Invertebrate [c]	Terrestrial Plant [d]	Mammal [e]	Bird [f]	Aquatic [g] Invertebrate	Aquatic Plant	Fish
INORGANICS									
Aluminum	NA		7.5E-02 [h]	8.0E-04 [i]	7.5E-02 [j]	7.5E-02	7.5E-02	6.0E-03 [k]	9.5E+01 [l]
Antimony	NA		5.0E-02 [h]	4.0E-02 [i]	5.0E-02 [j]	5.0E-02	[m]	[m]	[m]
Arsenic	NA		6.6E-03 [n]	3.0E-01 [o]	1.0E-01 [j]	6.0E-03	6.6E-03	3.0E-01 [o]	2.8E+02 [p]
Beryllium	NA		5.0E-02 [h]	2.0E-03 [i]	5.0E-02 [j]	5.0E-02	[m]	[m]	[m]
Barium	NA		7.5E-03 [h]	3.0E-02 [i]	7.5E-03 [j]	7.5E-03	7.5E-03	2.5E-02 [k]	4.0E+00 [p]
Cadmium	NA		1.4E+00 [q]	3.3E+01 [r]	2.1E+00 [j]	3.8E-01 [s]	1.4E+00	4.1E-01 [k]	3.2E+02 [l]
Chromium	NA		1.6E-01 [p]	1.5E-03 [i]	2.8E-01 [j]	2.8E-01	1.6E-01	6.3E-03 [k]	2.0E+02
Cobalt	NA		1.0E+00 [h]	4.0E-03 [i]	1.0E+00 [j]	1.0E+00	1.0E+00	9.3E-03 [k]	[m]
Copper	NA		1.6E-01 [t]	7.8E-01 [u]	6.0E-01 [r]	6.0E-01	1.6E-01	6.0E-02 [k]	3.4E+02 [l]
Lead	NA		7.8E-02 [v]	9.0E-03 [i]	1.5E-02 [j]	1.5E-02	7.8E-02	5.6E-02 [w]	1.5E+02 [l]
Manganese	NA		2.0E-02 [h]	5.0E-02 [i]	2.0E-02 [j]	2.0E-02	2.0E-02	1.3E-01 [k]	1.7E+03 [l]
Mercury	NA		6.8E-02 [x]	1.8E-01 [i]	1.0E-02 [y]	2.3E+00	1.7E+01 [z]	2.4E-01 [k]	6.3E+04 [p]
Nickel	NA		2.3E-01 [aa]	1.2E-02 [i]	3.0E-01 [j]	3.0E-01	2.3E-01	1.4E-02 [w]	[m]
Selenium	NA		7.6E-01 [n]	9.0E-03 [ab]	7.5E-01 [j]	5.1E-01 [ac]	7.6E-01	1.6E-01 [k]	8.3E+00 [p]
Vanadium	NA		1.3E-01 [h]	1.1E-03 [i]	1.2E-01 [j]	1.2E-01	1.3E-01	1.1E-03 [i]	1.0E-02 [p]
Zinc	NA		1.8E+00 [t]	6.1E-01 [r]	2.1E+00 [j]	2.1E+00	1.8E+00	9.2E-01 [k]	2.3E+02 [l]
PESTICIDES/PCBs									
4,4'-DDD	6		3.3E+00 [ad]	1.0E-02 [ae]	1.2E+00 [af]	2.9E+00 [ag]	2.1E+01 [ah]	1.0E-02 [ae]	[m]
4,4'-DDE	5.7		1.7E+00 [ad]	1.0E-02 [ae]	1.2E+00 [af]	2.9E+00 [ag]	2.1E+00 [ah]	1.0E-02 [ae]	[m]
4,4'-DDT	6.4		5.7E-01 [ad]	1.0E-02 [ae]	1.2E+00 [af]	2.9E+00 [ag]	2.1E+00 [ah]	1.0E-02 [ae]	[m]
Aroclor-1242	4.1 [ai]		5.8E+00 [t]	1.2E-01 [aj]	3.8E+00 [ak]	3.2E-01 [al]	5.8E+00 [t]	1.2E-01 [aj]	[m]
Aroclor-1260	7.1 [ai]		5.8E+00 [t]	1.2E-01 [aj]	3.8E+00 [ak]	3.2E-01 [al]	5.8E+00 [t]	1.2E-01 [aj]	[m]
alpha-Chlordane	5.5		1.6E+00 [ar]	5.1E-03	5.5E-01 [as]	1.8E+00 [at]	[m]	[m]	[m]
gamma-Chlordane	5.5		1.6E+00 [au]	5.1E-03	5.5E-01 [as]	1.8E+00 [at]	[m]	[m]	[m]
Dieldrin	4.6		5.5E+00 [am]	1.7E-02	1.5E+00 [an]	4.4E-01 [ao]	5.5E+00 [am]	1.7E-02	[m]
SEMIVOLATILES									
1,2-Dichlorobenzene	3.4	3.5	5.0E-02	7.3E-02	1.5E-01	1.5E-01	5.0E-02	7.3E-02	[m]
1,4-Dichlorobenzene	3.5	3.5	5.0E-02	7.3E-02	1.5E-01	1.5E-01	5.0E-02	7.3E-02	[m]
2-Methylnaphthalene	-1.9	4.3	5.0E-02	2.5E-02	1.5E-01	1.5E-01	5.0E-02	2.5E-02	[m]
Acenaphthylene	4.1	4.3	5.0E-02	2.5E-02	1.5E-01	1.5E-01	[m]	[m]	[m]
Benzo(b)fluoranthene	6.1	4.3	[m]	[m]	[m]	[m]	5.0E-02	2.5E-02	[m]
Benzo(k)fluoranthene	6.1	4.3	5.0E-02	2.5E-02	1.5E-01	1.5E-01	5.0E-02	2.5E-02	[m]
Bis(2-ethylhexyl)phthalate	5.1	5.2	5.0E-02	7.6E-03	2.4E-01	2.4E-01	5.0E-02	7.6E-03	3.1E+02 [p]
Chrysene	5.7	4.3	5.0E-02	2.5E-02	1.5E-01	1.5E-01	5.0E-02	2.5E-02	[m]
Dibenzofuran	4.1	4.1	5.0E-02	3.3E-02	1.5E-01	1.5E-01	5.0E-02	3.3E-02	[m]
Di-n-butylphthalate	5.2	5.2	5.0E-02	7.6E-03	2.4E-01	2.4E-01	5.0E-02	7.6E-03	[m]
Fluoranthene	4.95 [ap]	4.3	5.0E-02	2.5E-02	1.5E-01	1.5E-01	5.0E-02	2.5E-02	[m]
Naphthalene	3.6	4.3	5.0E-02	2.5E-02	1.5E-01	1.5E-01	5.0E-02	2.5E-02	[m]
Phenanthrene	4.5	4.3	5.0E-02	2.5E-02	1.5E-01	1.5E-01	5.0E-02	2.5E-02	3.2E+02 [aq]
Pyrene	5.3	4.3	5.0E-02	2.5E-02	1.5E-01	1.5E-01	5.0E-02	2.5E-02	[m]
VOLATILES									
1,2-Dichloroethylenes	2.0		NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane	2.5		NA	NA	NA	NA	[m]	[m]	[m]
Acetone	-0.24		NA	NA	NA	NA	NA	NA	NA
Benzene	2.1		[m]	[m]	[m]	[m]	NA	NA	[m]
Carbon disulfide	2.2		[m]	[m]	[m]	[m]	[m]	[m]	NA
Chlorobenzene	2.8		NA	NA	NA	NA	NA	NA	NA
Chloroform	2.0		NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	3.2		NA	NA	NA	NA	NA	NA	NA
Methylene chloride	1.3		NA	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	3.4		NA	NA	NA	NA	NA	NA	NA
Toluene	2.79		NA	NA	NA	NA	NA	NA	NA
Trichloroethylene	2.4		NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	2.5		NA	NA	NA	NA	NA	NA	NA
Xylenes	3.2		NA	NA	NA	NA	NA	NA	NA

NOTES:
[a] Units for bioaccumulation factors (BAFs) are mg/kg fresh wt tissue over mg/kg dry wt soil for terrestrial invertebrates and plants, mg/kg fresh wt. tissue

Analyte	log K_{ow} [b]	Bioaccumulation Factor [a]						Bioconcentration Factor [a]
		Terrestrial Invertebrate [c]	Terrestrial Plant [d]	Mammal [e]	Bird [f]	Aquatic [g] Invertebrate	Aquatic Plant	Fish

over mg/kg fresh wt. food for small mammals and small birds, and mg/kg fresh wt. tissue over mg/kg fresh wt. sediment for aquatic plants and organisms. No BAFs were calculated for VOAs since available evidence suggests that these analytes do not bioaccumulate. Units for bioconcentration factors (BCFs) are µg/kg fresh wt. tissue over µg/L water. BCFs are presented for only those analytes that are selected as surface water CPCs.

[b] From Superfund Chemical Data Matrix (USEPA, 1993) unless otherwise noted. Log K_{ow}s for classes of semivolatile compounds were averaged to provide an average BAF value. Compounds were grouped accordingly: PAHs (4.3), phthalates (5.2), dibenzofuran (4.1), and dichlorobenzenes (3.5).

[c] Average of earthworm BAFs for SVOCs (Beyer, 1990) converted from dry weight to wet weight assuming earthworm is 80% water, unless otherwise noted. When no earthworm data were available, the BAF for small mammals was used as a surrogate.

[d] Plant BAF calclulated using the following equation presented by Travis and Arms (1988) unless otherwise noted: log (Plant Uptake Factor)=1.588-0.578 (log Kow). Converted from dry weight to wet weight plant concentration assuming 80% water content.

[e] Calculated using the following equation in Travis and Arms (1988) for semivolatile organic analytes with log K_{ow}s >5: log BTF (biotransfer factor) = log K_{ow} - 7.6; result multiplied by average ingestion rates for non-lactating and lactating test animals to convert from BTFs to BAFs, and divided by a factor of 0.2 to convert from dry feed to fresh feed. There is an uncertainty involved in using this equation for PAHs because this study did not use any PAHs in the regression analysis. BAFs for analytes with log K_{ow}s <5 are assumed to be 0.15 because they are unlikely to bioaccumulate in animal tissue (Maughan, 1993).

[f] Bioaccumulation data are generally lacking for avians. When no bird data were available, the BAF for small mammals was used as a surrogate.

[g] Used to represent bioaccumulation from sediment to fish and aquatic invertebrates. Sediment BAFs are presented for only those analytes that were selected as sediment CPCs. When no aquatic BAF data were available, the BAF for terrestrial inverebrates was used as a surrogate.

[h] Prey-specific value not available; value shown is small mammal BAF for this chemical.

[i] Value from Baes et al. (1984) for leafy portions of plants multiplied by 0.2 to represent 80% water composition of plants.

[j] Value derived from biotransfer factors (BTFs), presented in Baes et al. (1984) for uptake into cattle. BTF converted to BAF by multiplying by food ingestion rate of 50 kg/day wet weight.

[k] Aquatic plant BAFs derived from an uptake study (Cherry & Guthrie, 1979) with two sedge species, *Andropogon virginicus* and *Cyperus retrofractus*, that were exposed to contaminated sediment. Values were converted from dry weight plant tissue to wet weight by applying a factor of 0.2 (assuming plants are 80% water).

[l] Geometric mean of BCFs obtained from AQUIRE (1994) and AWQC documents (calculated in Appendix O, Table O-1.4).

[m] This receptor group is not likely to be exposed to this CPC. Receptor exposures to analytes detected in surface soil include terrestrial invertebrates, terrestrial plants, mammals, and birds. Receptor exposures to analytes detected in surface water and sediment include aquatic organisms, aquatic plants, small fish, semi-aquatic mammals, and semi-aquatic birds.

[n] Average of values for industrial soils from Beyer and Cromatie (1987) multiplied by 0.2 to represent 80% water composition in earthworms.

[o] Average of BAF values reported from Wang et al. (1984), Sheppard et al. (1985), and Merry et al. (1986).

[p] From Barnthouse *et al.* (1988).

[q] Mean of values reported for soil invertebrates in MacFadyen (1980) converted from dry weight to wet weight.

[r] Mammal value for copper and plant value for cadmium from Levine et al., 1989.

[s] Based on accumulation of cadmium in kidneys of European quail in Pimentel et al. (1984).

[t] BCF for earthworms from Diercxsens et al. (1985).

[u] Median of values reported from Levine et al. (1989).

[v] Geometric mean of BAF values (fresh wt./dry wts) for worms and woodlice (USEPA, 1985). Fresh weight tissue concentrations calculated assuming 80% body water content.

[w] Values for lead and nickel from Mudroch & Capobianco (1979) represent an average of BAFs from sediment in several lakes, rivers, and bays into water lilies. Values converted from dry weight plant tissue to wet weight by applying a factor of 0.2 (assuming plants are 80% water).

[x] Uptake value (fresh wt./dry wt.) for earthworms from USEPA (1985) sludge document. Fresh weight tissue concentrations calculated assuming 80% body water

[y] USEPA, 1985.

[z] Based on the ranges of mercury concentrations in sediment and macroinvertebrates in an eight lake ecosystem in Sweden. Sediment concentrations ranged from 0.05 to 0.3 µg/g dry weight (mid point = 0.18 µg/g) and macroinvertebrate concentrations ranged from 0.02 to 6 µg/g dry weight (mid point = 3.01 µg/g). Based on these midpoints, a bioaccumulation factor of 16.7 was obtained.

[aa] Value from nickel sludge document (USEPA, 1985) multiplied by 0.2 to represent 80% water composition of earthworms.

[ab] Based on reported ratio of selenium in plant tissue and iron fly ash amended soil (Stoewsand et. al., 1978).

[ac] Based on average of reported ratio of selenium in diet to liver, kidney, and breast tissue of chickens (Eisler, 1985).

[ad] Geometric means of 4,4'-DDT [Davis (1968), Davis & Harrison (1966), Wheatley & Hardman (1968), Bailey et al. (1970), Cramp & Olney (1967), and Beyer & Gish (1980)], 4,4'-DDE [Davis (1968), Davis & Harrison (1966), Cramp & Olney (1967), Collett & Harrison (1968), Hunt & Sacho (1969), and Gish (1970)], and 4,4-DDD [Barker (1958), Davis (1968), Davis & Harrison (1966), Cramp & Olney (1967), Collett & Harrison (1968), Wheatley & Hardman (1968), Hunt & Sacho (1969), Bailey et al. (1970), Dimond et al. (1970), Gish (1970), and Beyer & Gish (1980)] reported for earthworms. Dry soil concentrations calculated assuming 10% moisture content in sandy-loam soils (Donahue et al., 1977).

[ae] Geometric mean of 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE BAFs (fresh wt/dry wt) reported for roots (carrot, potato, sugar beet), grains (corn, oats), and legumes (alfalfa) derived from USEPA (1985b) converted from dry weight to wet-weight per values provided by Suter (1993).

[af] BAF for shrews and voles calculated using measured concentrations of DDT_R in stomach content and in whole body (Forsyth & Petrle, 1984).

[ag] Whole-body pheasant BAF for 4,4'-DDT presented in USEPA (1985b); derived from Kenaga (1973).

[ah] Amphipod to sediment mean biomagnification factor for total DDT in Lake Michigan and Lake Ontario (Evans *et al.*, 1991).

Table O-1.2
Summary of Bioaccumulation and Bioconcentration Data
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Analyte	log K_{ow} [b]	Bioaccumulation Factor [a]						Bioconcentration Factor [a]
		Terrestrial Invertebrate [c]	Terrestrial Plant [d]	Mammal [e]	Bird [f]	Aquatic [g] Invertebrate	Aquatic Plant	Fish

[ai] USEPA (1990a) Basics of Pump-and-Treat Ground-Water Remediation Technology
[aj] Arthmetic mean BAF for corn, leaves, carrots, beets, sugarbeets, radishes, and soybeans (tops, roots, and whole plants) from USEPA (1985a) and Webber etal.
[ak] BAF calculated from discussion in Eisler (1986) stating that Aroclor 1254 residues in subcutaneous fat of adult minks were up to 38 times dietary levels. Converted to whole body concentrations assuming 10% lipid content.
[al] BAF calculated from data presented in Eisler, 1986. Kestrels fed 33 mg PCB/kg diet for 62-69 days accumulated 107 mg PCB/kg lipid weight in muscle Assuming muscle is 10%lipid content, the muscle concentration is about 10.7 mg/kg.
[am] Geometric mean of reported BAFs for earthworms (Edwards & Thompson, 1973). Values provided by Gish (1970) were converted from dry weight to wet weight by multiplying by a conversion factor of 0.2 assuming 80% water content.
[an] BAF calculated from data presented by Potter et al (1974). Based on an average dieldrin concentration in cow muscle and fat of 0.17 mg/kg (dry weight) and a dieldrin concentration of 0.11 mg/kg in the diet (dry weight).
[ao] Jeffries and Davis (1968).
[ap] USEPA (1992), Dermal Exposure Guidance.
[aq] BCFs for PAHs obtained from Eisler (1987).
[ar] Value for gamma-chlordane used as a surrogate.
[as] BAF calculated from data presented in Eisler, 1990. Rats fed 20 mg/kg diet technical chlordane (equivalent to 3.6 mg/kg diet cis- and trans-chlordane) for 350 days accumulated 20 mg/kg in lipids. Assuming 10% lipid content, the whole body concentration is about 2 mg/kg.
[at] BAF calculated from data presented in Eisler, 1990. Red-winged blackbirds fed 10 mg/kg diet technical chlordane (equivalent to 1.8 mg/kg diet cis- and trans- chlordane) for 84 days accumulated 1.8 mg/kg wet weight whole body residue.
[au] Geometric mean of reported BAFs for earthworms (Gish, 1970) converted from dry weight to wet weight assuming 80% water composition of earthworms.
NA = Not available

Table O-1.3
Summary of Oligochaete Bioaccumulation Factors and Summary of Crayfish and Fish Tissue Concentrations
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Site ID	Analyte [1]	Sediment Data (µg/g dry weight)	Oligochaete Data (µg/g wet weight)	Oligochaete Bioaccumulation Factors [2]
Control	4,4'-DDD	NA	ND	0.00E+00
	4,4'-DDE	NA	ND	0.00E+00
	4,4'-DDT	NA	ND	0.00E+00
	Aldrin[3]	NA	0.0397	NA
	Aroclor-1260	NA	ND	0.00E+00
	Dieldrin	NA	ND	0.00E+00
	% Lipids	NA	2.0	NA
57D-95-05X	4,4'-DDD	0.0258	ND	0.00E+00
	4,4'-DDE	ND	ND	0.00E+00
	4,4'-DDT	0.0363	ND	0.00E+00
	Aldrin[3]	ND	ND	NA
	Aroclor-1260	0.301	ND	0.00E+00
	Dieldrin	0.0183	ND	0.00E+00
	% Lipids	NA	1.5	NA
57D-95-06X	4,4'-DDD	0.44	ND	0.00E+00
	4,4'-DDE	0.162	ND	0.00E+00
	4,4'-DDT	0.0759	ND	0.00E+00
	Aldrin[3]	ND	0.0166	NA
	Aroclor-1260	ND	ND	0.00E+00
	Dieldrin	ND	ND	0.00E+00
	% Lipids	NA	1.3	NA
57D-95-08X	4,4'-DDD	0.49	ND	0.00E+00
	4,4'-DDE	0.18	ND	0.00E+00
	4,4'-DDT	0.12	ND	0.00E+00
	Aldrin[3]	ND	0.0216	NA
	Aroclor-1260	ND	ND	0.00E+00
	Dieldrin	ND	ND	0.00E+00
	% Lipids	NA	0.5	NA

Analyte [4]	Station 1 Crayfish (µg/g wet weight)	Station 2 Crayfish (µg/g wet weight)	Station 4 Crayfish (µg/g wet weight)	Station 6 Crayfish (µg/g wet weight)	Station 2 Suckers (µg/g wet weight)	Station 1 Pickerels (µg/g wet weight)
% Lipids	1.0	1.1	0.6	1.4	1.8	1.8
4,4'-DDD	<0.001	<0.001	<0.001	<0.001	0.0809	0.0295
4,4'-DDE	<0.001	<0.001	0.00291	0.0126	0.0754	0.0313
Aroclor-1260	0.263	<0.02	<0.02	<0.02	0.0472	0.26
alpha-Chlordane	<0.001	<0.001	<0.001	<0.001	0.00523	<0.001
gamma-Chlordane	<0.001	<0.001	<0.001	<0.001	0.00232	<0.001
Dieldrin	<0.001	<0.001	<0.001	<0.001	<0.001	0.00383
Heptachlor	<0.001	<0.001	0.00116	<0.001	<0.001	0.00224

Analyte [5]	Average Crayfish Tissue Concentration (µg/g) for Muskrat, Mallard, and Raccoon Exposures [6]	Average Fish Tissue Concentration (µg/g) for Great blue heron Exposures [6]
4,4'-DDD	0	0.0552
4,4'-DDE	0.00413	0.0534
Aroclor-1260	0.0733	0.154
Dieldrin	0	0.00217

NOTES:
[1] Only those analytes that were detected in oligochaete tissue are presented.
[2] Units for BAFs are equal to mg/kg wet weight tissue over mg/kg dry weight sediment. All BAFs are assumed to be zero because none of the CPCs were detected in oligochaete tissue.
[3] The tissue results for aldrin are listed; however, aldrin was not detected in any AOC 57 sediments and was not evaluated in the AOC 57 ERA. Tissue concentrations of aldrin may be attributable to spike contamination in the analytical equipment at the laboratory.
[4] Only those analytes that were detected in crayfish or fish tissue are presented.
[5] Only those analytes that were detected in sediments and retained as CPCs are presented.
[6] Average tissue concentrations use 1/2 the detection limit for non-detects, unless an analyte was not detected at all in which case a tissue concentration of zero was used.
NA = Not available, not applicable
ND = Not detected

Table O–1.4
Bioconcentration Data
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Chemical Name	Species	Age	Exposure	Concentration (μg/L)	BCF	ln (BCF)	Reference	Year of Publ.
Inorganics								
Aluminum	Salvelinus fontinalis; Brook trout	0.2 grams, 30 days	56 days	268	36	3.583518938	AQUIRE, 1994	91
Aluminum chloride	Unio pictorum; Mussel;	9.4 (7.7–10.18) cm	3 weeks	166.8 to 414.3	250	5.521460917	AQUIRE, 1994	90
						95 = Geometric Mean BCF for Aluminum		
Cadmium	Spirulina platensis; Blue–green algae	NR	12 hours	100	14.61	2.681706225	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	24 hours	100	18.3	2.906901059	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	36 hours	100	18	2.890371757	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	48 hours	100	16.1	2.778819272	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	12 hours	500	7.81	2.055404963	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	24 hours	500	8.77	2.171336806	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	36 hours	500	8.56	2.147100190	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	48 hours	500	7.42	2.004179057	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	12 hours	1000	6.22	1.827769906	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	24 hours	1000	7.04	1.951608170	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	36 hours	1000	7.14	1.965712776	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	48 hours	1000	6.77	1.912501086	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	12 hours	5000	3.06	1.118414916	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	24 hours	5000	2.79	1.026041595	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	36 hours	5000	2.63	0.966983846	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	48 hours	5000	2.1	0.741937344	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	12 hours	10000	2.42	0.883767540	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	24 hours	10000	1.85	0.615185639	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	36 hours	10000	1.69	0.524728528	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	48 hours	10000	1.55	0.438254930	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	12 hours	100	16.76	2.818995095	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	24 hours	100	14.02	2.640484881	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	36 hours	100	13.04	2.568021556	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	48 hours	100	13.41	2.596000697	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	12 hours	500	8.56	2.147100190	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	24 hours	500	7.64	2.033397603	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	36 hours	500	7.36	1.996059932	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	48 hours	500	6.5	1.871802176	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	12 hours	1000	6.13	1.813194749	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	24 hours	1000	6	1.791759469	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	36 hours	1000	6.16	1.818076777	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	48 hours	1000	4.13	1.418277407	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	12 hours	5000	3.38	1.217875709	AQUIRE, 1994	86
	Spirulina platensis; Blue–green algae	NR	24 hours	5000	3.08	1.124929597	AQUIRE, 1994	86

Table O-1.4
Bioconcentration Data
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Chemical Name	Species	Age	Exposure	Concentration ($\mu g/L$)	BCF	ln (BCF)	Reference	Year of Publ.
Cadmium (cont.)	Spirulina platensis; Blue-green algae	NR	36 hours	5000	3.03	1.108562619	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae	NR	48 hours	5000	2.63	0.966983846	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae	NR	12 hours	10000	2.63	0.966983846	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae	NR	24 hours	10000	2.31	0.837247524	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae	NR	36 hours	10000	2.21	0.792992515	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae	NR	48 hours	10000	2.2	0.788457360	AQUIRE, 1994	86
			Average ln(BCF) for Blue-green algae =			**1.67**		
	Oncorhynchus mykiss; Rainbow trout	46.21 grams	72 days	0.00127	55	4.007333185	AQUIRE, 1994	89
	Coregonus clupeaformis; Lake whitefish	26.63 grams	72 days	0.00125	42.1	3.740047740	AQUIRE, 1994	89
	Cladoceran				320	5.768320995	USEPA, 1980	
	Crayfish				184	5.214935757	USEPA, 1980	
	Stonefly				373	5.921578419	USEPA, 1980	
	Mayfly				1,630	7.396335293	USEPA, 1980	
	Mayfly				3,520	8.166216268	USEPA, 1980	
			Average ln(BCF) for Mayfly =			**7.78**		
	Dragonfly				736	6.601230118	USEPA, 1980	
	Dragonfly				680	6.522092798	USEPA, 1980	
	Dragonfly				1,300	7.170119543	USEPA, 1980	
	Dragonfly				928	6.833031732	USEPA, 1980	
			Average ln(BCF) for Dragonfly =			**6.78**		
	Caddisfly				4,190	8.340456012	USEPA, 1980	
	Beetle				164	5.099866427	USEPA, 1980	
	Beetle				260	5.560681631	USEPA, 1980	
			Average ln(BCF) for Bettle =			**5.33**		
	Midge				2,220	7.705262474	USEPA, 1980	
	Midge				1,830	7.512071245	USEPA, 1980	
	Biting midge				936	6.841615476	USEPA, 1980	
	Biting midge				662	6.495265555	USEPA, 1980	
			Average ln(BCF) for Midge =			**7.14**		
	Snail				1,750	7.467371066	USEPA, 1980	
						319	**= Geometric Mean BCF for Cadmium**	
Copper	Spirulina platensis; Blue-green algae;	NR	12 hours	100	36.65	3.601413428	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	100	39.51	3.676553804	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	100	31.2	3.440418094	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	100	25.38	3.233961462	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	12 hours	500	12.5	2.525728644	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	500	17	2.833213344	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	500	12.7	2.541601993	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	500	11.4	2.433613355	AQUIRE, 1994	86

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Bioconcentration Data
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Chemical Name	Species	Age	Exposure	Concentration (µg/L)	BCF	ln (BCF)	Reference	Year of Publ.
Copper (cont.)	Spirulina platensis; Blue-green algae;	NR	12 hours	1000	8.13	2.095560923	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	1000	12.2	2.501435951	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	1000	9.53	2.254444717	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	1000	8.13	2.095560923	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	12 hours	5000	2.6	0.955511445	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	5000	4.99	1.607435909	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	5000	4.27	1.451613827	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	5000	3.68	1.302912752	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	12 hours	10000	1.46	0.378436435	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	10000	3.4	1.223775431	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	10000	3.07	1.121677561	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	10000	2.68	0.985816794	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	12 hours	100	28.31	3.343215099	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	100	36.01	3.583796677	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	100	35.39	3.566429294	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	100	31.18	3.439776863	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	12 hours	500	9.37	2.237513096	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	500	11.02	2.399711803	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	500	12	2.484906649	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	500	11.47	2.439734931	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	12 hours	1000	5.76	1.750937474	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	1000	6.22	1.827769906	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	1000	7.81	2.055404963	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	1000	8.58	2.149433913	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	12 hours	5000	1.93	0.657520002	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	5000	2.12	0.751416088	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	5000	2.45	0.896088024	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	5000	2.41	0.879626747	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	12 hours	10000	1.2	0.182321556	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	24 hours	10000	1.35	0.300104592	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	36 hours	10000	1.49	0.39877612	AQUIRE, 1994	86
	Spirulina platensis; Blue-green algae;	NR	48 hours	10000	1.38	0.322083499	AQUIRE, 1994	86
			Average ln(BCF) for Blue-green algae =			1.95		
	Asiatic clam				19,800	9.893437216	USEPA, 1985a	
	Cladoceran				471	6.154858094	USEPA, 1985a	
	Stonefly				203	5.313205979	USEPA, 1985a	
						339	= Geometric Mean BCF for Copper	
Lead	Salvelinus fontinalis; Brook trout	FINGERLING, 7.3-10 c	3 weeks	4.1 to 88	1,400	7.244227515	AQUIRE, 1994	75
	Salvelinus fontinalis; Brook trout	FINGERLING, 7.3-10 c	3 weeks	135	41.9	3.735285826	AQUIRE, 1994	75

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Chemical Name	Species	Age	Exposure	Concentration ($\mu g/L$)	BCF	ln (BCF)	Reference	Year of Publ.
Lead (cont.)	Salvelinus fontinalis; Brook trout	FINGERLING, 7.3-10 c	3 weeks	135	7.78	2.051556338	AQUIRE, 1994	75
	Salvelinus fontinalis; Brook trout	FINGERLING, 7-10 cm	3 weeks	4.3	160	5.075173815	AQUIRE, 1994	75
	Salvelinus fontinalis; Brook trout	FINGERLING, 7-10 cm	3 weeks	5.7	140	4.941642422	AQUIRE, 1994	75
	Salvelinus fontinalis; Brook trout	FINGERLING, 7-10 cm	3 weeks	12.5	73	4.290459441	AQUIRE, 1994	75
	Salvelinus fontinalis; Brook trout	FINGERLING, 7-10 cm	3 weeks	12.5	32	3.465735902	AQUIRE, 1994	75
	Salvelinus fontinalis; Brook trout	FINGERLING, 7-10 cm	3 weeks	12.5	24	3.178053830	AQUIRE, 1994	75
	Salvelinus fontinalis; Brook trout	FINGERLING, 7-10 cm	3 weeks	12.5	48	3.871201010	AQUIRE, 1994	75
	Salvelinus fontinalis; Brook trout	FINGERLING, 7-10 cm	3 weeks	12.5	160	5.075173815	AQUIRE, 1994	75
	Salvelinus fontinalis; Brook trout	FINGERLING, 7-10 cm	3 weeks	12.5	16	2.772588722	AQUIRE, 1994	75
			Average ln(BCF) for Brook trout =			**4.15**		
	Colisa fasciata; Giant gourami	NR	8 hours	902	2.9	1.064710737	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	8 hours	902	0.8	-0.22314355	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	16 hours	0.860	3.4	1.223775431	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	16 hours	0.860	0.4	-0.91629073	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	16 hours	0.860	1	0	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	24 hours	801	3.4	1.223775431	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	24 hours	801	0.3	-1.20397280	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	24 hours	801	1.1	0.095310179	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	5 days	1000	5	1.609437912	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	5 days	1000	0.5	-0.69314718	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	5 days	1000	3.9	1.360976553	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	10 days	701	6.9	1.931521411	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	10 days	701	0.7	-0.35667494	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	10 days	701	6.1	1.808288771	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	15 days	586	5.3	1.667706820	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	15 days	586	0.8	-0.22314355	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	15 days	586	5.7	1.740466174	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	20 days	621	7.2	1.974081026	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	20 days	621	0.7	-0.35667494	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	20 days	621	6.5	1.871802176	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	25 days	601	8	2.079441541	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	25 days	601	0.9	-0.10536051	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	25 days	601	7.1	1.960094784	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	8 hours	1799	0.9	-0.10536051	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	8 hours	1799	0.6	-0.51082562	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	8 hours	1799	0.8	-0.22314355	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	16 hours	1602	1.8	0.587786664	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	16 hours	1602	0.8	-0.22314355	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	16 hours	1602	1.8	0.587786664	AQUIRE, 1994	91

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Chemical Name	Species	Age	Exposure	Concentration ($\mu g/L$)	BCF	ln (BCF)	Reference	Year of Publ.
Lead (cont.)	Colisa fasciata; Giant gourami	NR	24 hours	1523	1.7	0.530628251	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	24 hours	1523	0.8	−0.22314355	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	24 hours	1523	2.1	0.741937344	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	5 days	1544	3.1	1.131402111	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	5 days	1544	1.2	0.182321556	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	5 days	1544	3.2	1.163150809	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	10 days	1368	2.8	1.029619417	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	10 days	1368	2.1	0.741937344	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	10 days	1368	4.2	1.435084525	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	15 days	1402	4.5	1.504077396	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	15 days	1402	1.5	0.405465108	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	15 days	1402	3.7	1.308332819	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	20 days	1301	6.8	1.916922612	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	20 days	1301	1.9	0.641853886	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	20 days	1301	4.9	1.589235205	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	25 days	1300	4.9	1.589235205	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	25 days	1300	1.8	0.587786664	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	25 days	1300	5	1.609437912	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	8 hours	4324	0.8	−0.22314355	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	8 hours	4324	0.4	−0.91629073	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	8 hours	4324	1	0	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	16 hours	4300	1.7	0.530628251	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	16 hours	4300	0.6	−0.51082562	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	16 hours	4300	1	0	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	24 hours	4285	1.4	0.336472236	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	24 hours	4285	0.5	−0.69314718	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	24 hours	4285	1.6	0.470003629	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	5 days	4188	4.2	1.435084525	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	5 days	4188	0.9	−0.10536051	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	5 days	4188	2.2	0.788457360	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	10 days	4180	4.2	1.435084525	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	10 days	4180	1	0	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	10 days	4180	3.8	1.335001066	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	15 days	4060	4.5	1.504077396	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	15 days	4060	1.1	0.095310179	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	15 days	4060	3.9	1.360976553	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	20 days	4000	4.9	1.589235205	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	20 days	4000	1.4	0.336472236	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	20 days	4000	4.4	1.481604540	AQUIRE, 1994	91

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Chemical Name	Species	Age	Exposure	Concentration (µg/L)	BCF	ln (BCF)	Reference	Year of Publ.
Lead (cont.)	Colisa fasciata; Giant gourami	NR	25 days	4000	4.5	1.504077396	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	25 days	4000	1.4	0.336472236	AQUIRE, 1994	91
	Colisa fasciata; Giant gourami	NR	25 days	4000	4.3	1.458615022	AQUIRE, 1994	91
			Average ln(BCF) for Giant gourami =			**0.69**		
	Snail				1,700	7.43838353	USEPA, 1985b	
	Snail				738	6.603943824	USEPA, 1985b	
			Average ln(BCF) for Snail =			**7.02**		
	Stonefly				1,120	7.021083964	USEPA, 1985b	
	Caddisfly				499	6.212606095	USEPA, 1985b	
						151	**= Geometric Mean BCF for Lead**	
Manganese	Physa sp; Pouch snail;	NR	NR	165.1	1,300	7.170119543	AQUIRE, 1994	77
	Physa sp; Pouch snail;	NR	NR	142.9	800	6.684611727	AQUIRE, 1994	77
			Average ln(BCF) for Snail =			**6.93**		
	Corbicula fluminea; Asiatic clam	NR	NR	60	470	6.152732694	AQUIRE, 1994	80
	Corbicula fluminea; Asiatic clam	NR	NR	60	1,800	7.495541943	AQUIRE, 1994	80
	Corbicula fluminea; Asiatic clam	NR	NR	70	470	6.152732694	AQUIRE, 1994	80
	Corbicula fluminea; Asiatic clam	NR	NR	70	2,100	7.649692623	AQUIRE, 1994	80
			Average ln(BCF) for Asiatic clam =			**6.86**		
	Plankton; Plankton;	NR	NR	32	690	6.536691597	AQUIRE, 1994	78
	Oligochaeta; Annelid worm class	NR	NR	32	88	4.477336814	AQUIRE, 1994	78
	Insecta; Insect class;	NR	NR	32	28	3.332204510	AQUIRE, 1994	78
	Osteichthyes; Class – bony fishes	661–824 grams	NR	32	84	4.430816798	AQUIRE, 1994	78
	Lemna minor; Duckweed;	NR	NR	148.5	10,900	9.296518068	AQUIRE, 1994	75
	Lemna sp; Duckweed;	NR	NR	16.66 to 23.23	46,647	10.75036389	AQUIRE, 1994	80
			Average ln(BCF) for Duckweed =			**10.02**		
	Chironomidae; Midge family;	LARVAE	NR	< 30	3,900	8.268731832	AQUIRE, 1994	82
	Crustacea; Crustacean class;	NR	NR	< 30	1,100	7.003065458	AQUIRE, 1994	82
	Unio pictorum; Mussel;	12.5 grams	NR	< 30	160,000	11.98292909	AQUIRE, 1994	82
	Anodonta cygnea; Swan mussel;	28.5 grams	NR	< 30	350,000	12.76568843	AQUIRE, 1994	82
			Average ln(BCF) for Mussel =			**12.37**		
	Abramis brama; Bream;	350 grams	NR	< 30	600	6.396929655	AQUIRE, 1994	82
	Abramis brama; Bream;	350 grams	NR	< 30	240	5.480638923	AQUIRE, 1994	82
	Abramis brama; Bream;	350 grams	NR	< 30	170	5.135798437	AQUIRE, 1994	82
			Average ln(BCF) for Bream =			**5.67**		
	Stizostedion lucioperca; Pikeperch	500 grams	NR	< 30	260	5.560681631	AQUIRE, 1994	82
	Stizostedion lucioperca; Pikeperch	500 grams	NR	< 30	210	5.347107530	AQUIRE, 1994	82
	Stizostedion lucioperca; Pikeperch	500 grams	NR	< 30	70	4.248495242	AQUIRE, 1994	82
			Average ln(BCF) for Pikeperch =			**5.05**		
	Melosira varians; Diatom;	NR	NR	16.66 to 23.23	59,052	10.98617369	AQUIRE, 1994	80

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Chemical Name	Species	Age	Exposure	Concentration ($\mu g/L$)	BCF	ln (BCF)	Reference	Year of Publ.
Manganese (cont.)	Elodea sp; Waterweed;	NR	NR	16.66 to 23.23	12,465	9.430679996	AQUIRE, 1994	80
	Planaria sp; Planarian, flatworm	NR	NR	16.66 to 23.23	2,255	7.720905251	AQUIRE, 1994	80
	Tubifex sp; Tubificid worm;	NR	NR	16.66 to 23.23	14,583	9.587611745	AQUIRE, 1994	80
						1,665	**= Geometric Mean BCF for Manganese**	
Zinc	Asiatic clam				126.2	4.837867950	USEPA, 1987	
	Asiatic clam				71.6	4.271095074	USEPA, 1987	
	Asiatic clam				102.2	4.626931677	USEPA, 1987	
				Average ln(BCF) for Asiatic clams =		**4.58**		
	Mayfly				1,130	7.029972911	USEPA, 1987	
	Stonefly				106	4.663439094	USEPA, 1987	
						227	**= Geometric Mean BCF for Zinc**	

NOTES:

NR = Not Reported
cm = centimeters

Table O-1.5
Ingestion Toxicity Information for Wildlife
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Chemical	Test Species	Test Type	Duration	Effect	Lethal RTV mg/kgBW-day Oral LD_{50}	Lethal RTV mg/kgBW-day LOAEL	Sublethal RTV mg/kgBW-day LOAEL	Sublethal RTV mg/kgBW-day NOAEL	Reference
INORGANIC ANALYTES									
Aluminum	Mouse	Oral (chronic)	2-3 genrtns	Reduced body weight gain of newborns			425		NIOSH, 1985
	Rat	Oral (subchronic)	15 days	Reduced growth			100		Bernuzzi, et al., 1989
	Rat	Oral LD_{50}	NR	Mortality	3,700				Sax, 1984
Antimony	Rat	Oral (acute)	Single oral dose	NOAEL for death		16,714			ATSDR, 1991a
	Rat	Oral (chronic)	NS	Longevity; blood glucose; cholesterol			0.35 (water)		IRIS, 1993
	Rat	Oral (subchronic)	24 weeks	Decreased RBC, swelling of hepatic cords			41.8		ATSDR, 1991a
Arsenic	Rat	Oral	NR	Reproductive effects			0.61		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			0.58		RTECS, 1993
	Rat	Oral LD_{50}	NR	Mortality	763				RTECS, 1993
	Mouse	Oral LD_{50}	NR	Mortality	145				RTECS, 1993
	Mallard	Oral LD_{50}	NR	Mortality	323				Eisler, 1988
	Cowbird	Oral LD_{50}	11 days	Mortality	18.1 [a]				Eisler, 1988
	Young chicken	Oral	56 days	Egg production				1	Hermeyer et. al., 1977
	Dog	Oral (chronic)	2 years	Mortality		3.1			ATSDR, 1991b
Barium	Rat	Oral (chronic)	68 weeks	Renal ultrastructure changes			142		IRIS, 1993
	Rat	Oral (subchronic)	13 weeks	Renal effects			91		Dietz et al., 1992
	Rat	Oral (acute)	10 days	Decreased ovarian weight			198		ATSDR, 1991b
	Rat	Oral (subchronic)	13 weeks	20% population mortality		430			Dietz et al., 1992
Beryllium	Rat	Oral LD_{50}	NR	Mortality	10				USEPA, 1985g
	Rat	Oral (chronic)	NR	Increase in lung sarcomas			0.22		USEPA, 1985g
	Rat	Oral (chronic)	3.2 years	Respiratory, cardiopulmonary, hematological, and hepatic effects			0.85		ATSDR, 1991d
Cadmium	Rat	Oral	NR	Reproductive effects			155		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			220		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			21.5		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			23		RTECS, 1993
	Rat	Oral LD_{50}		Mortality	250				Eisler, 1985
	Rat	Oral LD_{50}	NR	Mortality	225				RTECS, 1993
	Mouse	Oral LD_{50}	NR	Mortality	890				RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			448		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			1,700		RTECS, 1993
	Guinea pig	Oral LD_{50}	NR	Mortality	150				Eisler, 1985
	Mallard	Oral (subchronic)	90 days	Egg production suppressed			10		Eisler, 1985
Chromium	Japanese quail	Oral LD_{50}	5 days	Mortality	126				Hill and Camardese, 1986
	Rat	Oral (subchronic)	90 days	Histopathologic and reproductive effects				1,400	Ivankovic and Preussman, 1975
	Mouse	Oral (chronic)	7 weeks	Decreased spermatogenesis			3.5		ATSDR, 1993a
	Black Duck	Oral (subchronic)	5 months	Reproductive effects				200	Outridge and Scheuhammer, 1993
	Rat	Oral LD_{50}		Mortality	200				ATSDR, 1991c
Cobalt	Rat	Oral LD_{50}		Mortality	91				ATSDR, 1991d
	Rat	Single oral dose		Hepatic/renal hyperemia					ATSDR, 1991d
	Rat	Oral (subchronic)	8 weeks	Decreased body weight gain			4.2		ATSDR, 1991d
	Rat	Oral (chronic)	98 days	Testicular degeneration			13		ATSDR, 1991d
	Rat	Oral (chronic)	69 days	Testicular atrophy			20		ATSDR, 1991d
	Dog	Oral (subchronic)	4 weeks	Increased red blood cell count			5		ATSDR, 1991d
Copper	Rat	Single oral dose		Reproductive effects			152		NIOSH, 1985 and RTECS, 1993
	Rat	Oral LD_{50}	NR	Mortality	940				Sax, 1984
	Mouse	Oral (chronic)	30 days	Decreased litter sizes with teratogenic effects			100		Lecyk, 1980
Lead	Rat	Oral	NR	Reproductive effects			790		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			1,140		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			520		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			1,100		RTECS, 1993
	Calf	Oral LD_{50}	NR	Mortality	220				Eisler, 1988
	Rat	Oral (subchronic)	12-14 days	Decreased fetal body weight			2.5		McClain and Becker, 1972
	Mouse	Oral	NR	Reproductive effects			1,120		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			6,300		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			300		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			4,800		RTECS, 1993
	Domestic animal	Oral	NR	Reproductive effects			662		RTECS, 1993
	Mammal	Oral	NR	Reproductive effects			2,118		RTECS, 1993
	Kestrel	Diet	NR	Decreased egg laying fertility; decreased egg shell thickness				4.61 [a]	Eisler, 1988

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Lead (cont.)	Kestrel nestlings	Oral	10 days	Reduced growth and brain weight; abnormal development			125		Eisler, 1988
	Japanese quail	Oral LD_{50}	5 days	Mortality	24,752				Hill and Camardese, 1986
	Rat	Oral (chronic)	2 generations	Developmental effects				7	Kimmel et al., 1980 and Grant et al., 1980
	Guinea pig	Oral LD_{50}		Mortality	300				Sax, 1984
	Rock dove	Oral (chronic)	NS	Kidney pathology; learning deficiences			6.25		Anders et al., 1982 and Dietz et al., 1979
	Rock dove	Oral LD_{50}		Mortality	375				Kendall and Scanlon, 1985
Manganese	Mouse	Oral (subchronic)	90 days	Delayed growth of testes			140		ATSDR, 1990b
	Mouse	Oral (chronic)	103 weeks	Mortality			4,050		ATSDR, 1990b
	Rat	Oral LD_{50}	NR	Mortality	410				ATSDR, 1990b
	Rat	Oral LD_{50}	20 days	Mortality	225				ATSDR, 1990b
	Rat	Oral (subchronic)	20 days	Decreased litter weight during gestation				620	ATSDR, 1990b
	Rat	Oral (chronic)	103 weeks	Mortality			930		ATSDR, 1990b
	Guinea pig	Oral LD_{50}	NR	Mortality	400				USEPA, 1984a
	Monkey	Oral (chronic)	18 months	Weakness, rigidity			25		ATSDR, 1990b
	Rodents/livestock	Oral (subchronic)	10 days – 2 months	Decreased growth rate			100		Cunningham et al., 1966
	Mouse	Oral (subchronic)	180 days	NOAEL for mortality		2,300			Gianutsos and Murray, 1982
Mercury	Mouse	Oral LD_{50}		Mortality	22				NIOSH, 1985
	Mouse	Oral (subchronic)	Day 6–17 (gest)	Stillbirths and neonatal death			4		Suzuki, 1979
	Rat	Oral (subchronic)	Day 6–14 (gest)	Retarded fetus growth			4		Suzuki, 1979
organomercury	Rat	Oral (chronic)	NR	Reduced fertility			0.5		Eisler, 1987a
	Rat	Oral LD_{50}		Mortality	18				NIOSH, 1985
organomercury	Pig	Oral (subchronic)	Pregnancy	High incidence of stillbirths			0.5		Eisler, 1987a
organomercury	Mule deer	Oral LD_{50}		Mortality	17.9				Eisler, 1987a
organomercury	River otter	Oral LD_{50}		Mortality	2				Eisler, 1987a
organomercury	Mink	Oral LD_{50}		Mortality	1				Eisler, 1987a
organomercury	Dog	Oral (subchronic)	Pregnancy	High incidence of stillbirths			0.1		Eisler, 1987a
methylmercury	House sparrow	Oral LD_{50}		Mortality	12.6				Eisler, 1987a
ethylmercury	Rock dove	Oral LD_{50}		Mortality	22.8				Eisler, 1987a
	Chicken	Oral LD_{50}		Mortality	20				Fimreite, 1979
	Bantam chicken	Oral LD_{50}		Mortality	190				Fimreite, 1979
ethylmercury	Prairie chicken	Oral LD_{50}		Mortality	11.5				Eisler, 1987a
ethylmercury	Chukar	Oral LD_{50}		Mortality	26.9				Eisler, 1987a
methylmercury	Corturnix	Oral LD_{50}		Mortality	11				Eisler, 1987a
methylmercury	Mallard	Oral	3 generation	Reproduction, behavior			0.064		USEPA, 1993
methylmercury	Black duck	Oral (subchronic)	28 weeks	Reproduction inhibited			0.22 [a]		Eisler, 1987a
methylmercury	Fulvous whistling duck	Oral LD_{50}		Mortality	37.8				Eisler, 1987a
methylmercury	Northern bobwhite	Oral LD_{50}		Mortality	23.8				Eisler, 1987a
methylmercury	Bobwhite quail	Oral LD_{50}	5 days	Mortality	523				Hill et al., 1975
	Japanese quail	Oral LD_{50}		Mortality	14.4				Eisler, 1987a
ethylmercury	Gray partridge	Oral LD_{50}		Mortality	17.6				Eisler, 1987a
organomercury	Gray pheasant	Oral (subchronic)	30 days	Reduced reproductive ability			0.64		Eisler, 1987a
methylmercury	Ring-necked pheasant	Oral LD_{50}		Mortality	11.5				Eisler, 1987a
	Mouse	Oral (subchronic)	50 days	Embryotoxicity and teratogenicity			0.9		Suzuki, 1979
Nickel	Rat	Oral	NR	Reproductive effects			158		RTECS, 1994
	Rat	Oral LD_{50}	NR	Mortality	67				USEPA, 1985h
	Rat	Oral (chronic)	2 years	Decreased body weight gain			50		USEPA, 1985h
	Rat	Oral LD_{50}	NR	Mortality	350				Sax, 1984
	Japanese quail	Oral (acute)	5 days	Mortality	504				Hill and Camardese, 1986
	Dog	Oral (chronic)	2 years	Histological lesions in bone marrow			62.5		USEPA, 1987
Selenium	Rat	Oral LD_{50}	NR	Mortality	6,700				RTECS, 1993
	Rat	Oral LD_{50}	NR	Mortality	138				Sax, 1984
	Mouse	Oral	NR	Reproductive effects			134		RTECS, 1993
	Mallard	Oral (subchronic)	3 months	Reduced hatchability			1.75		Eisler, 1985
	Rat	Oral (chronic)	2 years	Decrease in breeding			0.2		ATSDR, 1988
	Rat	Oral (chronic)	NS	Histological changes in heart and kidney			0.045		Eisler, 1985
	Japanese quail	Oral (chronic)	NS	Reduced egg hatching			0.6		Eisler, 1985
	Mallard	Oral (subchronic)	3 months	NOAEL for taratogenic effects			0.72	0.36	Eisler, 1985
	Horse	Oral LD_{50}		MLD	3.3				Eisler, 1985
	Mallard	Oral	6 weeks	Increased mortality		2.7 [a]			Heinz et al., 1988

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Selenium (cont.)	Black–crowned night heron	Oral	NR	NOAEL for egg hatchability				0.61 [a]	Smith et al., 1988
Vanadium	Japanese quail	Oral LD_{50}	5 days	Mortality	$\boxed{96}$				Hill and Camaardese, 1986
	Mouse	Gavage LD_{50}	One time	Mortality	$\boxed{31}$				ATSDR, 1990c
	Rat	Oral (subchronic)	2 months	Hypertension			15		Susic and Kentera, 1986
	Rat	Oral (subchronic)	35 days	Developmented effects				$\boxed{8.4}$	Domingo, et al., 1986
	Chicken	Oral (subchronic)	6 weeks	Decrease in egg–laying			$\boxed{11}$ [b]		Berg et al., 1963
Zinc	Rat	Oral LD_{50}		Mortality	2,510				RTECS, 1993
	Rat	Oral	Gestation	Fetal resorptions in 4 to 20% of population			$\boxed{200}$		Shlicker and Cox, 1968
	Ferret	Oral	3–13 days	Mortality and gastrointestinal effects		$\boxed{390}$			Straube et al., 1980
	Rat	Oral (subchronic)	NR	Kidney toxicity			160		Llobet, et al., 1988
PESTICIDES/PCBs									
4,4'–DDE	Rat	Oral LD_{50}	NR	Mortality	800				RTECS, 1993
	Mouse	Oral LD_{50}	NR	Mortality	$\boxed{700}$				RTECS, 1993
	Hamster	Oral LD_{50}	NR	Mortality	>5,000				RTECS, 1993
	Mallard	Oral	NR	Eggshell thinning			2.91		USEPA, 1993c
	Mallard	Oral	2 years	Reproductive: embryo mortality, cracked eggs			$\boxed{0.58}$		USEPA, 1993c
	Kestrel	Oral	NR	Eggshell thinning			$\boxed{0.39}$		USEPA, 1993c
4,4'–DDT (surrogate for 4,4'–DDD and 4,4'–DDE)	Rat	Oral LD_{50}	NR	Mortality	$\boxed{87}$				RTECS, 1993
	Rat	Oral LD_{50}		Mortality	100				USEPA, 1985d
	Rat	Oral	NR	Reproductive			112		RTECS, 1993
	Rat	Oral	NR	Reproductive			100		RTECS, 1993
	Rat	Oral	NR	Reproductive			430		RTECS, 1993
	Rat	Oral	NR	Reproductive			1,890		RTECS, 1993
	Rat	Oral	NR	Reproductive			250		RTECS, 1993
	Rat	Oral	NR	Reproductive			50		RTECS, 1993
	Rat	Oral (chronic)	3 generations	Reproductive			$\boxed{0.2}$		IRIS, 1991
	Rat	Oral	2 years	Reproductive			2.5		USEPA, 1993c
	Mouse	Oral LD_{50}	NR	Mortality	135				RTECS, 1993
	Mouse	Oral LD_{50}		Mortality	200				USEPA, 1985d
	Mouse	Oral	NR	Reproductive			504		RTECS, 1993
	Mouse	Oral	NR	Reproductive			81		RTECS, 1993
	Mouse	Oral	NR	Reproductive			124		RTECS, 1993
	Mouse	Oral	NR	Reproductive			148		RTECS, 1993
	Rabbit	Oral LD_{50}	NR	Mortality	250				RTECS, 1993
	Rabbit	Oral	NR	Reproductive			150		RTECS, 1993
	Guinea pig	Oral LD_{50}	NR	Mortality	150				RTECS, 1993
	Hamster	Oral LD_{50}	NR	Mortality	>5,000				RTECS, 1993
	Dog	Oral LD_{50}	NR	Mortality	150				RTECS, 1993
	Dog	Oral LD_{50}		Mortality	$\boxed{60}$				USEPA, 1985d
	Dog	Oral	NR	Reproductive			3,540		RTECS, 1993
	Dog	Oral (chronic)	14 months	Stillbirths, delayed estrus, reduced libido, lack of mammary gland development, and increased deat			$\boxed{12}$		ATSDR, 1992b
	Monkey	Oral LD_{50}	NR	Mortality	200				RTECS, 1993
	Chicken	Oral (subchronic)	10 weeks	Decreased reproductive success; toxic symptoms			91.4 [a]		USEPA, 1985d
	Rock dove	Oral LD_{50}		Mortality	4,000				USFWS, 1984
	Black duck	Oral (chronic)	2 years	Reduced eggshell thickness			$\boxed{0.14}$ [a]		Longcore and Stendell, 1977
	Mallard	Oral LD_{50}		Mortality	2,240				USFWS, 1984
	Mallard	Oral (subchronic)	96 days	Reduced eggshell thickness			2.8		Longcore and Stendell, 1977
	Mallard	Oral	NR	Eggshell thinning			$\boxed{1.16}$		USEPA, 1993c
	Mallard	Oral	NR	Eggshell thinning			2.91		USEPA, 1993c
	Mallard	Oral	2 years	Reproductive			1.45		USEPA, 1993c
	California quail	Oral LD_{50}		Mortality	$\boxed{595}$				USFWS, 1984
	Japanese quail	Oral LD_{50}		Mortality	841				USFWS, 1984
	Pheasant	Oral LD_{50}		Mortality	1,334				USFWS, 1984
	Sandhill crane	Oral LD_{50}		Mortality	1,200				USFWS, 1984
	Kestrel	Oral (chronic)	7 wk – 1 yr	Reduced eggshell thickness			0.56a		USEPA, 1985d
	Kestrel	Oral (chronic)	1 year	Reduced eggshell thickness			0.16a		Wiemeyer, et al., 1986
	Barn owl	Oral (chronic)	2 years	Reduced eggshell thickness			$\boxed{0.14}$ [a]		Longcore and Stendell, 1977
Aroclor 1254 (surrogate for Aroclor 1242 and 1260)	Mouse	Oral	NR	Reproductive			1.53		USEPA, 1993c
	Chicken	Oral (chronic)	NR	Embryonic mortality			0.9		USEPA, 1976
	Rock dove	Oral (chronic)	NR	Parental incubation behavior			$\boxed{0.9}$		Peakall and Peakall, 1973

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Aroclor 1254 (cont.)	American kestrel	Oral (chronic)	69 days	Reduced sperm concentration			9		Eisler, 1986
	Mink	Oral dose	160 days	Reproductive			0.096		USEPA, 1993c
	Mink	Oral	NR	Kit growth			0.15		USEPA, 1993c
	Mink	Oral	12.5 days	Reproductive			0.375		USEPA, 1993c
	Chicken	Oral	39 weeks	Egg production and fertility			2.44		USEPA, 1993c
	Chicken	Oral	NR	Egg production and hatchability			9.8		USEPA, 1993c
	Chicken	Maternal diet	NR	Chick growth			0.98		USEPA, 1993c
	Pheasant	Oral	16 weeks	Egg hatchability			1.8		USEPA, 1993c
Aroclor 1260	Rat	Oral LD_{50}	NR	Mortality	1,315				RTECS, 1993
	Rat	Oral LD_{50}	NR	Mortality	500				Eisler, 1986
	Rat	Oral LD_{50}	NR	Mortality	1,300				Eisler, 1986
	Rat	Oral	NR	Reproductive effects			1,674		RTECS, 1993
	Rat	Oral (chronic)	2 generations	Reduced litter size			7.6		USEPA, 1985
	Rat	Oral (subchronic)	9 weeks	Fetal mortality; maternal toxicity			6.4		ATSDR, 1987
	Mouse	Oral	NR	Reproductive effects			74		RTECS, 1993
	Mink	Oral LD_{50}		Mortality	4,000				Eisler, 1986
	Mink	Oral LD_{50}		Mortality	3,000				Eisler, 1986
	Mink	Oral LD_{50}		Mortality	750				Eisler, 1986
	Mink	Oral (subchronic)	4 months	Impaired reproduction			0.0075		Newell et al., 1987
	Bobwhite	Oral LD_{50}	8 days	Mortality	80 [a]				Eisler, 1986
	Mallard	Oral LD_{50}	8 days	Mortality	111				Eisler, 1986
gamma−Chlordane (surrogate for alpha−chlordane)	Rat	Oral LD50	NR	Mortality	283				RTECS, 1993
	Rat	Oral LD50		Mortality	430				Allen et al., 1979
	Rat	Oral LD50		Mortality	335				Allen et al., 1979
	Rabbit	Oral LD50		Mortality	300				Allen et al., 1979
	Rabbit	Oral LD50		Mortality	100				Allen et al., 1979
	Dog	Oral LD50		Mortality	200				Allen et al., 1979
	Goat	Oral LD50		Mortality	180				Allen et al., 1979
	Rat	Oral(subchronic)	Multi−generational	Decreased fertility			16		ATSDR, 1992a
	Japanese quail	Oral LD50	5 days	Mortality	35				Hill et al., 1975
	Bobwhite	Oral LD50	5 days	Mortality	29				Hill et al., 1975
	Mallard	Oral LD50	5 days	Mortality	62				Hill et al., 1975
	Pheasant	Oral LD50		Mortality	24				USFWS, 1984
	Mouse	Oral (chronic)	2 years	Hepatocelluar hypertrophy and necrosis			0.47		ATSDR, 1992a
	Mouse	Oral (chronic)	30 months	Regional liver hypertrophy (females)			0.273	0.055	ATSDR, 1992a
	Dog	Oral (chronic)	2 years	Histologic changes			0.375		USEPA, 1988a
	Young chicken	Chronic	4 week	Egg hatchability and growth				0.031 [b]	Eisler, 1990
Dieldrin	Mouse	Oral LD_{50}	NR	Mortality	38				Allen et al., 1979
	Mouse	Oral (chronic)	80 weeks	Body tremors			0.33		NCI, 1978
	Mouse	Oral (chronic)	2 year	Liver enlargement w/ histopathology			0.1		IRIS, 1991
	Mouse	Oral (chronic)	2 year	Hepatic cancer			1.3		ATSDR, 1991e
	Rat	Oral (chronic)	2 year	Histologic changes			2		ATSDR, 1987b
	Rat	Oral (chronic)	2 year	Liver lesions			0.05	0.005	IRIS, 1991
	Dog	Oral (chronic)	2 year	Increased liver weight; liver/body weight			0.05	0.005	IRIS, 1991
	Dog	Oral (chronic)	25 months	Hepatocyte degeneration			0.5		ATSDR, 1987b
	Monkey	Oral (chronic)	120 days	Tremors and Convusions			0.1		Smith et al., 1976
	Mouse	Oral (subchronic)	4 wks	Decreased pup survival			0.65		Virgo & Bellward, 1975
	Rat	Oral (subchronic)	120 days	Operant behavior				0.025	Smith et al., 1976
	Rat	Oral LD_{50}	NR	Mortality	46				Allen et al., 1979
	Guinea pig	Oral LD_{50}	NR	Mortality	25				Allen et al., 1979
	Rabbit	Oral LD_{50}	NR	Mortality	45				Allen et al., 1979
	House sparrow	Oral LD_{50}	NR	Mortality	48				USFWS, 1984
	Chicken	Oral LD_{50}	NR	Mortality	20				Allen et al., 1979
	Rock dove	Oral LD_{50}	NR	Mortality	27				USFWS, 1984
	Gray partridge	Oral LD_{50}	NR	Mortality	9				USFWS, 1984
	Chukar	Oral LD_{50}	NR	Mortality	25				USFWS, 1984
	Japanese quail	Oral LD_{50}	5 days	Mortality	6 [a]				Hill et al., 1975
	Japanese quail	Oral LD_{50}	NR	Mortality	70				USFWS, 1984
	California quail	Oral LD_{50}	NR	Mortality	9				USFWS, 1984
	Bobwhite	Oral LD_{50}	5 days	Mortality	3 [a]				Hill et al., 1975
	Pheasant	Oral LD_{50}	NR	Mortality	79				USFWS, 1984

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Dieldrin (cont.)	Mallard	Oral LD_{50}	5 days	Mortality	12 [a]				Hill et al., 1975
	Mallard	Oral LD_{50}	5 days	Mortality	11 [a]				Hill et al., 1975
	Mallard	Oral LD_{50}	NR	Mortality	381				USFWS, 1984
	Whistling duck	Oral LD_{50}	NR	Mortality	100				USFWS, 1984
	Canada goose	Oral LD_{50}	NR	Mortality	141				USFWS, 1984
	Goat	Oral LD_{50}	NR	Mortality	100				Allen et al., 1979
	Sheep	Oral LD_{50}	NR	Mortality	50				Allen et al., 1979
	Cattle	Oral LD_{50}	NR	Mortality	60				Allen et al., 1979
	Mule deer	Oral LD_{50}	NR	Mortality	75				Allen et al., 1979
	Cat	Oral LD_{50}	NR	Mortality	300				Allen et al., 1979
	Dog	Oral LD_{50}	NR	Mortality	65				Allen et al., 1979
SEMIVOLATILE ORGANIC COMPOUNDS									
1,4–Dichlorobenzene	Rat	LD_{50}, gavage oil	14 days	Mortality	3,800				ATSDR, 1992
(& 1,2–DCB)	Mouse	Oral		Systemic, hepatocellular degeneration			300		ATSDR, 1992
2–Methylnaphthalene	Rat	Oral LD_{50}		Mortality	1,630				NIOSH, 1985
Acenaphthylene	Rat	Oral (chronic)	40 days	Physiological changes			600		USEPA, 1984
Benzo(a)pyrene (used as a	Rat	Oral (chronic)	Pregnancy	Sterility in offspring			40		USEPA, 1984a
surrogate for PAHs).	Rat	Oral (chronic)	3.5 months	Reproductive			50		USEPA, 1984a
	Mouse	Oral	Multi–generational	Decreased fertility of F1 progeny; decreased F2 litter size.			10 [c]		MacKenzie and Angevine, 1981
	Mouse	Oral (subchronic)	6 months	Mortality		120			ATSDR, 1993a
Benzo(b&k)fluoranthene	Rodents	Oral (chronic)	NS	Carcinogenicity			40		Eisler, 1987
Bis(2–ethylhexyl)phthalate	Rat	Oral LD_{50}	NR	Mortality	30,600				RTECS, 1993
	Rat	Oral	NR	Reproductive effects			7,140		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			35		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			6,000		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			17,200		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			10,000		RTECS, 1993
	Rat	Oral	NR	Reproductive effects			9,766		RTECS, 1993
	Mouse	Oral LD_{50}	NR	Mortality	30,000				RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			78,880		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			4,200		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			50		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			1,000		RTECS, 1993
	Mouse	Oral	NR	Reproductive effects			2,040		RTECS, 1993
	Rabbit	Oral LD_{50}	NR	Mortality	34,000				RTECS, 1993
	Guinea pig	Oral LD_{50}	NR	Mortality	26,000				RTECS, 1993
	Guinea pig	Oral	NR	Reproductive effects			20,000		RTECS, 1993
	Mammal	Oral	NR	Reproductive effects			20,000		RTECS, 1993
	Mammal	Oral	NR	Reproductive effects			509,000		RTECS, 1993
	Mouse	Oral LD_{50}		Mortality	800				RTECS, 1993
	Mouse	Oral (subchronic)	13 weeks	Renal effects			125		RTECS, 1993
Chrysene	Rodents	Oral (chronic)	NS	Carcinogenicity			99		Eisler, 1987a
Dibenzofuran	Rodents	Single oral dose		LC 20		500			ATSDR, 1991f
	Rodents	Oral (chronic)	13 weeks	LC 10		125			ATSDR, 1991f
	Mouse	Oral (chronic)	103 weeks	Multinuclear hepatocytes				60	ATSDR, 1991f
Di–n–butylphthalate	Rat	Oral (subchronic)	48 days	Reproductive effects			125		USEPA, 1989a
	Rat	Oral (chronic)	1 year	Mortality		600			IRIS, 1991
	Mouse	Oral LD_{50}		Mortality	5.28				Sax, 1984
	Rat	Oral LD_{50}		Mortality	12,000				Sax, 1984
Fluoranthene	Rat	Oral LD_{50}	NR	Mortality	2,000				RTECS, 1994
	Mouse	Oral (subchronic)	90 days	Nephropathy; clinical and pathological effects			250	125	IRIS, 1990
Naphthalene	Rat	Oral (chronic)	100 weeks	Ocular lesions			41		USEPA, 1990a
	Rat	Oral (subchronic)	13 weeks	Decreased body weight gain			35.7		USEPA, 1990a
	Mouse	Oral LD_{50}		Mortality	533				ATSDR, 1990a
Phenanthrene	Mouse	Oral LD_{50}	NR	Mortality	700				RTECS, 1994
	Mouse	Oral (subchronic)	6 months	Increased liver weight			120		USEPA, 1989a
Pyrene	Rat	Oral LD_{50}	NR	Mortality	2,700				RTECS, 1993 and NIOSH, 1985
	Mouse	Oral LD_{50}	NR	Mortality	800				RTECS, 1993 and NIOSH, 1985

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VOLATILE ORGANIC COMPOUNDS									
1,1-Dichloroethylene (surrogate for 1,2-Dichloroethylene)	Rat	Single oral dose	NR	Mortality	200				IRIS, 1988
	Rat	Oral (chronic)	2 years	Liver lesions			9		IRIS, 1988
	Rat	Oral (chronic)	2 years	Reproductive effects from 1,1-DCE administered via drinking water				30	ATSDR, 1992
1,1,1-Trichloroethane	Ginea Pig	Oral (subchronic)	90 days	Hepatotoxicity			90		IRIS, 1991
	Rat	Single oral dose		Mortality	10,300				NIOSH, 1985
	Rat	Oral (subchronic)	78 weeks	Reproductive effects				1500	USEPA, 1990
Acetone	Rat	Oral	NR	Reproductive effects			273,000		RTECS, 1993
	Rat	Oral LD_{50}	NR	Mortality	5,800				RTECS, 1993
	Rat	Oral LD_{50}		Mortality	9,750				Sax, 1984
	Mouse	Oral LD_{50}	NR	Mortality	3,000				RTECS, 1993
	Rabbit	Oral LD_{50}	NR	Mortality	5,340				RTECS, 1993
Benzene	Rat	Single oral dose		Mortality	3,800				TDB, 1984
	Rat	Oral (chronic)	187 days	Hematopoietic effects			10		USEPA, 1984
Carbon disulfide	Rabbit	Converted inhalation	34 weeks	NOAEL for Fetotoxicity/malformations				11	IRIS, 1991
Chlorobenzene	Rat	Oral (subchronic)	93 - 99 days	Increased liver and kidney weight			100		USEPA, 1984b
	Dog	Oral (subchronic)	13 weeks	Histopathological changes in liver			136		IRIS, 1991
	Mouse	Oral (subchronic)	13 weeks	Increased liver weight, hepatic necrosis			89		USEPA, 1984b
	Rat	Oral LD_{50}	Single dose	Mortality	1,000				ATSDR, 1989
Chloroform	Rat	Oral	NR	Mortality	908				RTECS, 1994
	Rat	Oral	NR	Reproductive effects			1,260		RTECS, 1994
	Rat	Oral	NR	Reproductive effects			4,000		RTECS, 1994
	Mouse	Oral	NR	Reproductive effects			2,177		RTECS, 1994
	Mouse	Oral	NR	Reproductive effects			2,115		RTECS, 1994
	Guinea pig	Oral	NR	Mortality	820				RTECS, 1994
	Rabbit	Oral	NR	Reproductive effects			260		RTECS, 1994
Ethylbenzene	Rat	Oral (subchronic)	182 days	Liver and kidney toxicity			291	97.1	IRIS, 1991
	Rat	Oral LD_{50}		Mortality	3,500				NIOSH, 1985
	Rat	LD_{50} (gavage)	1 day	Mortality	4,728				ATSDR, 1989
Methylene chloride	Rat	Oral LD_{50}	NR	Mortality	1,600				RTECS, 1994
	Dog	Oral LD_{50}	NR	Mortality	3,000				RTECS, 1994
	Rabbit	Oral LD_{50}	NR	Mortality	1,900				RTECS, 1994
	Rat	Oral (chronic)	2 years	Liver toxicity			52.6	5.9	IRIS,1991
Methylene chloride (cont.)	Rat	Oral (subchronic)	3 months	Mortality, blood chemistry, histopathology				12.5	USEPA, 1984b
Tetrachloroethylene	Rat	Single oral dose		Mortality	8,850				NIOSH, 1985
	Mouse	Single oral dose		Mortality	8,100				TBD, 1984
	Mouse	Oral (subchronic)	6 weeks	Hepatotoxicity			100		Buben and O'Flaherty, 1985
Toluene	Rat	Oral (subchronic)	13 weeks	Increased liver and kidney weight			446		IRIS, 1991
	Rat	Oral LD_{50}		Mortality	5,000				NIOSH, 1985
	Mouse	Oral (subchronic)	76 days	Decreased open field activity			76		ATSDR, 1992ac
Trichloroethene	Mouse	Single oral dose		Mortality	2,402				NIOSH, 1985
	Rat	Single oral dose		Mortality	7,193				NIOSH, 1985
	Mouse	Oral (multi-generational)	12 weeks	Decreased dam and fetal weights			750		ATSDR, 1991a
Trichlorofluoromethane	Mouse	LD_{50} (inter-peritoneal injection)		Mortality	1,743				Sax, 1984
Xylenes (total)	Rat	Oral LD_{50}		Mortality	4,300				NIOSH, 1985
	Rat	Oral (chronic)	103 weeks	Hyperactivity, decreased BW, mortality			500	250	IRIS, 1991
	Japanese quail	Oral (acute)	5 days	Mortality	20,000	2,014			Hill and Camardese, 1986

NOTES:
LD_{50} = Dose resulting in 50% mortality in test population
BW = Body weight
NR = Not reported
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
[a] Converted to dose per kilogram body weight by multiplying by ingestion and dividing by body weight. Body weights for birds obtained from Dunning, 1984.
Ingestion rates were calculated using the following regression equation (for all birds) from USEPA, 1993a: Food Ingestion (kg/day) = 0.00582 * Body Weight $^{0.651}$ (kg). Ingestion rates for the chicken from NRC, 1984 (pg. 13).
[b] Converted from 30 ppm to 11 mg/kgBW-day using standard default parameters (USEPA, 1988).
[c] Value for benzo(a)pyrene chosen as a surrogate for all PAHs. Chemical-specific toxicity studies for ecologically significant endpoints are lacking for other PAHs.

Table O-1.6
RTVs Selected for Ecological Risk Assessment (mg/kgBW/day) [a]
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Compound	Small Mammal [b]			Small Bird [c]			Predatory Mammal [d]			Predatory Bird [e]		
	Lethal	Sublethal	Selected RTV	Lethal	Sublethal	Selected RTV	Lethal	Sublethal	Selected RTV	Lethal	Sublethal	Selected RTV
Inorganic Analytes												
Aluminum	740	425	425	740	425	425	740	425	425	740	425	425
Antimony	16,714	41.8	41.8	16,714	41.8	41.8	16,714	41.8	41.8	16,714	41.8	41.8
Arsenic	29	0.58	0.58	3.6	1	1	3.1	0.58	0.58	3.6	1	1
Barium	430	198	198	430	198	198	430	198	198	430	198	198
Beryllium	2	0.85	0.85	2	0.85	0.85	2	0.85	0.85	2	0.85	0.85
Cadmium	30	21.5	21.5	30	10	10	30	21.5	21.5	30	10	10
Chromium	40	3.5	3.5	25.2	200	25.2	40	3.5	3.5	25.2	200	25.2
Cobalt	18.2	4.2	4.2	18.2	4.2	4.2	18.2	4.2	4.2	18.2	4.2	4.2
Copper	188	100	100	188	100	100	188	100	100	188	100	100
Lead	60	2.5	2.5	75	125	75	60	2.5	2.5	75	125	75
Manganese	45	100	45	45	100	45	45	100	45	45	100	45
Mercury	3.6	0.9	0.9	2.9	0.064	0.064	0.2	0.1	0.1	2.9	0.064	0.064
Nickel	13	50	13	100	50	50	13	50	13	100	50	50
Selenium	28	0.2	0.2	2.7	0.6/1.75 [h]	0.6/1.75	28	0.2	0.2	2.7	0.6	0.6
Vanadium	6	8.4	6	19.2	11	11	6	8.4	6	19.2	11	11
Zinc	390	200	200	390	200	200	390	200	200	390	200	200
Pesticides/PCBs												
4,4'-DDD	17.4	0.2	0.2	119/448 [h]	0.14/1.16 [h]	0.14/1.16	12	12	12	119	0.14	0.14
4,4'-DDE	140	0.2	0.2	119/448 [h]	0.39/0.58 [h]	0.39/0.58	140	12	12	119	0.39	0.39
4,4'-DDT	17.4	0.2	0.2	119/448 [h]	0.14/1.16 [h]	0.14/1.16	12	12	12	119	0.14	0.14
Aroclor-1242	100	6.4	6.4	16/22.2 [h]	0.9	0.9	150	0.0075	0.0075	16	9	9
Arokor-1260	100	6.4	6.4	16/22.2 [h]	0.9	0.9	150	0.0075	0.0075	16	9	9
alpha-Chlordane	20	16	16	4.8	0.031	0.031	40	16	16	4.8	0.031	0.031
gamma-Chlordane	20	16	16	4.8	0.031	0.031	40	16	16	4.8	0.031	0.031
Dieldrin	8	0.65	0.65	0.6/2.2 [h]	0.65	0.6/2.2	13	0.65	0.65	0.6	0.65	0.6
Semivolatile Organic Compounds												
1,2-Dichlorobenzene	760	NA	760	760	NA	760	760	NA	760	760	NA	760
1,4-Dichlorobenzene	760	NA	760	760	NA	760	760	NA	760	760	NA	760
2-Methylnaphthylene	326	10 [f]	10	326	10 [f]	10	326	10 [f]	10	326	10 [f]	10
Acenaphthylene	120 [f]	10 [f]	10	120 [f]	10 [f]	10	120 [f]	10 [f]	10	120 [f]	10 [f]	10
Benzo(b)fluoranthene	120 [f]	10 [f]	10	120 [f]	10 [f]	10	120 [f]	10 [f]	10	120 [f]	10 [f]	10
Benzo(k)fluoranthene	120 [f]	10 [f]	10	120 [f]	10 [f]	10	120 [f]	10 [f]	10	120 [f]	10 [f]	10
Bis(2-ethylhexyl)phthalate	160	35	35	160	35	35	160	35	35	160	35	35
Chrysene	120 [f]	10 [f]	10	120 [f]	10 [f]	10	120 [f]	10 [f]	10	120 [f]	10 [f]	10
Dibenzofuran	125	12.5 [g]	12.5	125	12.5 [g]	12.5	125	12.5 [g]	12.5	125	12.5 [g]	12.5
Di-n-butylphthalate	1.1	125	1.1	1.1	125	1.1	1.1	125	1.1	1.1	125	1.1
Fluoranthene	400	10 [f]	10	400	10 [f]	10	400	10 [f]	10	400	10 [f]	10
Naphthalene	107	35.7	35.7	107	35.7	35.7	107	35.7	35.7	107	35.7	35.7
Phenanthrene	140	10 [f]	10	140	10 [f]	10	140	10 [f]	10	140	10 [f]	10
Pyrene	160	10 [f]	10	160	10 [f]	10	160	10 [f]	10	160	10 [f]	10
Volatile Organic Compounds												
1,2-Dichloroethylene	40	30	30	40	30	30	40	30	30	40	30	30
1,1,1-Trichloroethane	2,060	1,500	1,500	2,060	1,500	1,500	2,060	1,500	1,500	2,060	1,500	1,500
Acetone	600	273,000	600	600	273,000	600	600	273,000	600	600	273,000	600
Benzene	760	NA	760	760	NA	760	760	NA	760	760	NA	760
Carbon disulfide	NA	11	11	NA	11	11	NA	11	11	NA	11	11
Chlorobenzene	100	89	89	100	89	89	100	89	89	100	89	89

Table O-1.6
RTVs Selected for Ecological Risk Assessment (mg/kgBW/day) [a]
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Compound	Small Mammal [b]			Small Bird [c]			Predatory Mammal [d]			Predatory Bird [e]		
	Lethal	Sublethal	Selected RTV	Lethal	Sublethal	Selected RTV	Lethal	Sublethal	Selected RTV	Lethal	Sublethal	Selected RTV
Chloroform	164	260	164	164	260	164	164	260	164	164	260	164
Ethylbenzene	700	291	291	700	291	291	700	291	291	700	291	291
Methylene chloride	320	52.6	52.6	320	52.6	52.6	600	52.6	52.6	600	52.6	52.6
Tetrachloroethylene	1,620	100	100	1,620	100	100	1,620	100	100	1,620	100	100
Toluene	1,000	76	76	1,000	76	76	1,000	76	76	1,000	76	76
Trichloroethylene	480	750	480	480	750	480	480	750	480	480	750	480
Trichlorofluoromethane	350	35 [g]	35	350	35 [g]	35	350	35 [g]	35	350	35 [g]	35
Xylenes	860	500	500	2,014	500	500	860	500	500	2,014	500	500

Notes:
[a] Lethal RTVs correspond to the boxed lethal RTV (one-fifth of the oral LD_{50} or the LOAEL) presented in Table __-5. When available, oral LD_{50} data were preferentially chosen. Sublethal RTVs correspond to the boxed sublethal RTV (LOAEL or NOAEL) presented in Table __-5. When available, sublethal LOAEL data were preferentially chosen.
[b] These RTVs represent chemical concentrations that are not anticipated to result in adverse effects for the short-tailed shrew, white-footed mouse, and muskrat.
[c] These RTVs represent chemical concentrations that are not anticipated to result in adverse effects for the American robin or mallard. When no data were available, the small mammal value was used as a surrogate.
[d] These RTVs represent chemical concentrations that are not anticipated to result in adverse effects for the red fox or the raccoon. When no data were available, the small mammal value was used as a surrogate.
[e] These RTVs represent chemical concentrations that are not anticipated to result in adverse effects for the barred owl or great blue heron. When no data were available, the small bird or predatory mammal value was used as a surrogate.
[f] The value for benzo(a)pyrene was used as a surrogate.
[g] A sublethal RTV was derived by applying a factor of 0.1 to the lethal RTV, which is expected to be protective of 99% of the population (USEPA, 1986).
[h] When injestion toxicity data were available for mallards, these data were preferentially chosen for evaluating food chain effects to mallards; other (more conservative) effects data may have been selected for evaluatng food chain exposures to all other bird species.

LD_{50} = Median lethal dose.
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level.
RTV = Reference toxicity value.
NA = Not available.

TABLE O-1.7
SUMMARY OF TOXICITY DATA FOR PLANT RECEPTORS
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Chemical	Reference	RTV in soil [a] ($\mu g/g$)
INORGANICS		
Aluminum	Will and Suter, 1994	50
Antimony	Will and Suter, 1994	5
Arsenic	Will and Suter, 1994	10
Barium	Will and Suter, 1994	500
Beryllium	Will and Suter, 1994	10
Cadmium	Will and Suter, 1994	3
Chromium	Will and Suter, 1994	1
Cobalt	Will and Suter, 1994	20
Copper	Will and Suter, 1994	100
Lead	Will and Suter, 1994	50
Manganese	Will and Suter, 1994	500
Nickel	Will and Suter, 1994	30
Selenium	Will and Suter, 1994	1
Vanadium	Will and Suter, 1994	2
Zinc	Will and Suter, 1994	50
PESTICIDES/PCBs		
4,4'-DDE		12.5 [b]
4,4'-DDT	Eno & Everett, 1958	12.5
Aroclors	Will and Suter, 1994	40
Dieldrin		12.5 [b]
SEMI-VOLATILE ORGANICS		
1,2-Dichlorobenzene	Hulzebos *et al.*, 1993 [d]	248
1,4-Dichlorobenzene	Hulzebos *et al.*, 1993 [d]	248
2-Methylnaphthalene		25 [c]
Bis(2-ethylhexyl)phthalate	Hulzebos *et al.*, 1993 [d]	>1,000
Dibenzofuran	Hulzebos *et al.*, 1993 [d]	617 [e]
Di-n-butylphthalate	Will and Suter, 1994	200
Fluoranthene		25 [c]
Naphthalene	Hulzebos *et al.*, 1993 [d]	100
Phenanthrene		25 [c]
Pyrene		25 [c]
VOLATILE ORGANICS		
1,2-Dichloroethylene		>1,000 [f]
Acetone		NA
Chloroform		>1,000 [f]
Ethylbenzene		200 [g]
Methylene chloride		>1,000 [f]
Tetrachloroethylene	Hulzebos *et al.*, 1993 [d]	>1,000
Toluene	Will and Suter, 1994	200
Trichlorofluoromethane		NA
Xylene (total)	Hulzebos *et al.*, 1993 [d]	>1,000

Notes:
[a] RTVs in soil are equal to chemical concentrations in soil that are not expected to result in adverse effects to plants.
[b] Value for 4,4'-DDT used as a surrogate.
[c] Value for acenaphthene used as a surrogate.
[d] Values represent 14-day growth EC_{50}s for *Lactuca sativa* in soil.
[e] Value for furan used as a surrogate.
[f] Value for tetrachloroethylene used as a surrogate.
[g] Value for toluene used as a surrogate
NA = Not available

TABLE O-1.8
SUMMARY OF TOXICITY DATA FOR TERRESTRIAL INVERTEBRATE RECEPTORS
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Chemical	Test Type	Test Duration	Test Species	Chemical Concentration (μg/g)	Effect	RTV (μg/g)	Reference
INORGANICS							
Aluminum	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA
Arsenic	Soil Test	14 day	*E. foetida*	100	0 % mortality	100	Bouche *et al.*, 1987
Arsenic	Soil Test	14 day	*E. foetida*	200	100 % mortality		Bouche *et al.*, 1987
Barium	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA
Cadmium	Soil Test	14 day	*E. foetida*	900	0 % mortality		Bouche *et al.*, 1987
Cadmium	Soil Test	14 day	*E. foetida*	2,700	100 % mortality		Bouche *et al.*, 1987
Cadmium	Soil Test	14 day	*E. foetida*	1,000 [a]	LC_{50}		van Gestel and van Dis, 1988
Cadmium	Soil Test	20 week	*E. foetida*	50 [b]	Decrease in cocoon production	50 [c]	Malecki *et al.*, 1982
Cadmium	Soil Test	2 week	*E. foetida*	1,843	LC_{50}		Neuhauser *et al.*, 1985
Chromium (III)	Soil Test	8 week	*E. foetida*	250	Reproduction 50% inhibited	250	Molnar *et al.*, 1989
Cobalt	NA	NA	NA	NA	NA	NA	NA
Copper	Soil Test	14 day	*E. foetida*	10	0 % mortality		Bouche *et al.*, 1987
Copper	Soil Test	14 day	*E. foetida*	30	20 % mortality	30	Bouche *et al.*, 1987
Copper	Soil Test	20 week	*E. foetida*	2,000 [b]	Decrease in cocoon production		Malecki *et al.*, 1982
Copper	Soil Test	2 week	*E. foetida*	643	LC_{50}		Neuhauser *et al.*, 1985
Lead	Soil Test	20 week	*E. foetida*	5,000 [b]	Decrease in cocoon production		Malecki *et al.*, 1982
Lead	Soil Test	2 week	*E. foetida*	5,941	LC_{50}	1,190 [c]	Neuhauser *et al.*, 1985
Manganese	NA	NA	NA	NA	NA	NA	NA
Nickel	Soil Test	20 week	*E. foetida*	400 [b]	Decrease in cocoon production	400	Malecki *et al.*, 1982
Nickel	Soil Test	2 week	*E. foetida*	757	LC_{50}		Neuhauser *et al.*, 1985
Selenium	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA
Zinc	Soil Test	20 week	*E. foetida*	5,000 [b]	Decrease in cocoon production		Malecki *et al.*, 1982
Zinc	Soil Test	2 week	*E. foetida*	662	LC_{50}	130 [c]	Neuhauser *et al.*, 1985
PESTICIDES/PCBs							
4,4'-DDE	Soil Test	NS	NS	60	58% mortality	12 [c]	U.S. EPA, 1985
4,4'-DDT	Soil Test	NS	NS	60	58% mortality	12 [c]	U.S. EPA, 1985
Aroclor-1242	NA	NA	NA	NA	NA	NA	NA
Aroclor-1260	NA	NA	NA	NA	NA	NA	NA
Dieldrin	Soil Test	89 day	*E. foetida*	10	6 % decrease in number of cocoons hatched		Reinecke and Venter, 1985
Dieldrin	Soil Test	89 day	*E. foetida*	30	26 % decrease in number of coc	30	Reinecke and Venter, 1985
Dieldrin	Soil Test	89 day	*E. foetida*	100	36 % decrease in number of cocoons hatched;		Reinecke and Venter, 1985
Dieldrin	Soil Test	89 day	*E. foetida*	100	50 % decrease in number of cocoons produced		Reinecke and Venter, 1985
SEMI-VOLATILE ORGANIC COMPOUNDS							
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	Soil Test	14 day	*E. foetida*	173	LC_{50}	34 [d]	Neuhauser *et al.*, 1985.
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	Soil Test	14 day	4 test species	2,390	LC_{50}	478 [e]	Neuhauser *et al.*, 1986.
Di-n-butylphthalate	Soil Test	14 day	4 test species	2,390	LC_{50}	478 [e]	Neuhauser *et al.*, 1986.

TABLE O-1.8
SUMMARY OF TOXICITY DATA FOR TERRESTRIAL INVERTEBRATE RECEPTORS
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Chemical	Test Type	Test Duration	Test Species	Chemical Concentration (µg/g)	Effect	RTV (µg/g)	Reference
Fluoranthene	Soil Test	14 day	*E. foetida*	173	LC_{50}	34 [d]	Neuhauser *et al.*, 1985.
Naphthalene	Soil Test	14 day	*E. foetida*	173	LC_{50}	34 [d]	Neuhauser *et al.*, 1985.
Phenanthrene	Soil Test	14 day	*E. foetida*	173	LC_{50}	34 [d]	Neuhauser *et al.*, 1985.
Pyrene	Soil Test	14 day	*E. foetida*	173	LC_{50}	34 [d]	Neuhauser *et al.*, 1985.
VOLATILE ORGANIC COMPOUNDS							
Chloroform	Soil Test	14 day	*E. foetida*	740	LC_{50}	150 [d]	Neuhauser *et al.*, 1985.
Ethylbenzene	Soil Test	14 day	*E. foetida*	106	LC_{50}	21 [d]	Neuhauser *et al.*, 1985.
Methylene chloride	Soil Test	14 day	*E. foetida*	740	LC_{50}	150 [d]	Neuhauser *et al.*, 1985.
Tetrachloroethylene	Soil Test	14 day	*E. foetida*	740	LC_{50}	150 [d]	Neuhauser *et al.*, 1985.
Toluene	Soil Test	14 day	*E. foetida*	106	LC_{50}	21 [d]	Neuhauser *et al.*, 1985.
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Xylene (total)	Soil Test	14 day	*E. foetida*	106	LC_{50}	21 [d]	Neuhauser *et al.*, 1985.
TOTAL PETROLEUM HYDROCARBONS							
Total Petroleum Hydrocarbons	NA	NA	NA	NA	NA	NA	NA

NOTES:
[a] LC_{50} value for soil at pH = 7.0; LC_{50} = 320 ug/g – 560 ug/g for soil pH = 4.1
[b] Acetate salt
[c] Conservative factor of 0.2 applied to endpoint; resultant value should be protective of 99.9% of the exposued population from acute effects (USEPA, 1986).
[d] Equal to the lowest LC_{50} in each chemical class, multiplied by a safety factor of 0.2, as described in text. Value for 2-chloroethyl vinyl ether used for all chlorinated volatiles. Value for carbaryl used for aromatic hydrocarbons. Value for fluorene used for PAHs. Value for carbaryl used for aromatic hydrocarbons.
[e] Mean of LC_{50}s for four test species (*A. teberculata, E. foetida, E. eugeniae*, and *P. excavatus*) from artificial soil tests; values used for a whole chemical class are multiplied by a factor of 0.2 (Neuhauser *et al.*, 1986). Value for dimethylphthalate used for phthalates.
NA = Not available
NS = Not stated

Table O.1−9
AQUIRE Freshwater Toxicity Information (μg/L)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
PAL Volatile Organics								
1,1−Dichloroethylene	Daphnia magna, water flea	<24 H	48 H	LC_{50}	79,000			80
	Daphnia magna, water flea	FIRST INSTAR	24 H	LC_{50}	11,600			80
	Daphnia magna, water flea	<24 H	48 H	lethality	$\boxed{2,400}$			80
	Daphnia magna, water flea	<24 H	24 H	LC_{50}	98,000			80
	Daphnia magna, water flea	FIRST INSTAR	48 H	LC_{50}	11,600			80
	Lepomis macrochirus, bluegill	33−75 MM	96 H	LC_{50}	220,000			77
	Lepomis macrochirus, bluegill	JUVENILE, 0.32−1.2 G	24 H	LC_{50}	74,000			81
	Lepomis macrochirus, bluegill	JUVENILE, 0.32−1.2 G	96 H	LC_{50}	74,000			81
	Lepomis macrochirus, bluegill	JUVENILE, 0.32−1.2 G	96 H	LC_{50}	140,000			81
	Lepomis macrochirus, bluegill	JUVENILE, 0.32−1.2 G	24 H	LC_{50}	165,000			81
	Pimephales promelas, fathead minnow	0.8 G, 35 MM, ADULT	8 D	LC_{50}	29,000			80
	Pimephales promelas, fathead minnow	ADULT, 0.8 G, 35 MM	96 H	LC_{50}	169,000			80
	Pimephales promelas, fathead minnow	0.8 G, 35 MM, ADULT	13 D	LC_{50}	29,000			80
	Pimephales promelas, fathead minnow	ADULT, 0.8 G, 35 MM	5 D	LC_{50}	97,000			80
	Pimephales promelas, fathead minnow	ADULT, 0.8 G, 35 MM	24 H	LC_{50}	116,000			80
	Pimephales promelas, fathead minnow	ADULT, 0.8 G, 35 MM	6 D	LC_{50}	74,000			80
	Pimephales promelas, fathead minnow	0.8 G, 35 MM, ADULT	10 D	LC_{50}	29,000			80
	Pimephales promelas, fathead minnow	ADULT, 0.8 G, 35 MM	7 D *	LC_{50}	29,000			80
	Pimephales promelas, fathead minnow	0.8 G, 35 MM, ADULT	12 D	LC_{50}	29,000			80
	Pimephales promelas, fathead minnow	ADULT, 0.8 G, 35 MM	48 H	LC_{50}	169,000			80
	Pimephales promelas, fathead minnow	ADULT, 0.8 G, 35 MM	48 H	LC_{50}	108,000			80
	Pimephales promelas, fathead minnow	0.8 G, 35 MM, ADULT	96 H	LC_{50}	108,000			80
	Pimephales promelas, fathead minnow	0.8 G, 35 MM, ADULT	9 D	LC_{50}	29,000			80
	Pimephales promelas, fathead minnow	ADULT, 0.8 G, 35 MM	24 H	LC_{50}	175,000			80
	Pimephales promelas, fathead minnow	0.8 G, 35 MM, ADULT	11 D	LC_{50}	29,000			80
	Scenedesmus abundans, green algae	10E4 CELLS/ML	96 H	GRO		410,000		85
Chlorobenzene	Brachydanio rerio; zebrafish;	FERTILIZED EGG	14 D	REP *	8,500	213279	90	
	Brachydanio rerio; zebrafish;	FERTILIZED EGG	21 D	REP *	8,500	213279	90	
	Brachydanio rerio; zebrafish;	FERTILIZED EGG	28 D	LC_{50}	10,300	213279	90	
	Brachydanio rerio; zebrafish;	FERTILIZED EGG	28 D	REP *	8,500	213279	90	
	Brachydanio rerio; zebrafish;	FERTILIZED EGG	7 D	REP *	8,500	213279	90	
	Brachydanio rerio; zebrafish;	NR	48 H	LC_{50}	10,500	315526	83	
	Carassius auratus; Goldfish;	3.8−6.4 CM, 1−2 G	24 H	LC_{50}	73,030	210728	66	
	Carassius auratus; Goldfish;	3.8−6.4 CM, 1−2 G	48 H	LC_{50}	56,000	210728	66	
	Carassius auratus; Goldfish;	3.8−6.4 CM, 1−2 G	96 H	LC_{50}	51,620	210728	66	
	Carassius auratus; Goldfish;	EGG	7.5 D	LC_{50}	1,040	210538	79	
	Carassius auratus; Goldfish;	EGG	7.5 D	LC_{50}	880	210538	79	
	Carassius auratus; Goldfish;	EGG	84 H	LC_{50}	4,080	210538	79	
	Carassius auratus; Goldfish;	EGG	84 H	LC_{50}	4,380	210538	79	
	Carassius auratus; Goldfish;	EGGS−4 D POST HATCH	8 D	LC_{50} *	1,040	210563	79	
	Carassius auratus; Goldfish;	EGGS−4 D POST HATCH	8 D	LC_{50} *	$\boxed{880}$	210563	79	
	Carassius auratus; Goldfish;	EGGS−4 D POST HATCH	96 H	LC_{50} *	2,370	210563	79	
	Carassius auratus; Goldfish;	EGGS−4 D POST HATCH	96 H	LC_{50} *	3,480	210563	79	
	Ceriodaphnia dubia; Water flea	NEONATE	48 H	LC_{50}	10,400	310810	85	
	Ceriodaphnia dubia; Water flea	NEONATE	48 H	LC_{50}	11,000	310810	85	
	Ceriodaphnia dubia; Water flea	NEONATE	48 H	LC_{50}	11,100	310810	85	
	Ceriodaphnia dubia; Water flea	NEONATE	48 H	LC_{50}	11,400	310810	85	
	Ceriodaphnia dubia; Water flea	NEONATE	48 H	LC_{50}	11,800	310810	85	
	Ceriodaphnia dubia; Water flea	NEONATE	48 H	LC_{50}	7,900	310810	[illegible]	

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
	Ceriodaphnia dubia; Water flea	NEONATE	48 H	LC_{50}	7,900	310810	85	
	Ceriodaphnia dubia; Water flea	NEONATE	48 H	LC_{50}	8,900	310810	85	
	Ceriodaphnia dubia; Water flea	NEONATE, <12 H	168 H	LC_{50}	24,000	210212	91	
	Ceriodaphnia dubia; Water flea	NEONATE, <12 H	48 H	LC_{50}	47,000	210212	91	
	Ceriodaphnia dubia; Water flea	NEONATE, <12 H	to 10 D	EC_{50}RE *	14,000	210212	91	
	Ceriodaphnia dubia; Water flea	NEONATE, <12 H	to 10 D	EC_{50}RE *	22,000	210212	91	
	Ceriodaphnia dubia; Water flea	NEONATE, <12 H	to 10 D	EC_{50}RE *	26,000	210212	91	
	Ceriodaphnia dubia; Water flea	NEONATE, <12 H	to 10 D	MOR *	3,890	210212	91	
	Ceriodaphnia dubia; Water flea	NEONATE, <12 H	to 10 D	REP *	12,000	210212	91	
	Ceriodaphnia dubia; Water flea	NEONATE, <12 H	to 10 D	REP *	19,000	210212	91	
	Ceriodaphnia dubia; Water flea	NEONATE, <12 H	to 10 D	REP *	19,000	210212	91	
	Culex quinquefasciatus; Mosquito	LARVAE, 4TH INSTAR	24 H	BCF	1.01	212480	75	
	Cyclotella meneghiniana; Diatom	EXPO GRO PHASE	48 H	EC_{50} *	235,740	210088	91	
	Daphnia magna; Water flea;	12 H	14 D	EC_{50}RE *	2,500	315526	83	
	Daphnia magna; Water flea;	24 H	24 H	LC_{50}	310,000	215718	77	
	Daphnia magna; Water flea;	<24 H	24 H	LC_{50}	140,000	215184	80	
	Daphnia magna; Water flea;	<24 H	48 H	LC_{50}	86,000	215184	80	
	Daphnia magna; Water flea;	<24 H	48 H	MOR *	10,000	215184	80	
	Daphnia magna; Water flea;	NEONATE	48 H	LC_{50}	10,700	310810	85	
	Daphnia magna; Water flea;	NEONATE	48 H	LC_{50}	11,500	310810	85	
	Daphnia magna; Water flea;	NEONATE	48 H	LC_{50}	12,800	310810	85	
	Daphnia magna; Water flea;	NEONATE	48 H	LC_{50}	12,900	310810	85	
	Daphnia magna; Water flea;	NEONATE	48 H	LC_{50}	13,000	310810	85	
	Daphnia magna; Water flea;	NEONATE	48 H	LC_{50}	15,400	310810	85	
	Daphnia magna; Water flea;	NEONATE	48 H	LC_{50}	21,300	310810	85	
	Daphnia magna; Water flea;	NEONATE	48 H	LC_{50}	8,600	310810	85	
	Daphnia magna; Water flea;	NEONATE, <12 H	240 H	LC_{50}	16,000	210212	91	
	Daphnia magna; Water flea;	NEONATE, <12 H	48 H	LC_{50}	31,000	210212	91	
	Daphnia magna; Water flea;	NEONATE, <12 H	to 11 D	EC_{50}RE *	15,000	210212	91	
	Daphnia magna; Water flea;	NEONATE, <12 H	to 11 D	EC_{50}RE *	16,000	210212	91	
	Daphnia magna; Water flea;	NEONATE, <12 H	to 11 D	EC_{50}RE *	19,000	210212	91	
	Daphnia magna; Water flea;	NEONATE, <12 H	to 11 D	MOR *	<1,400	210212	91	
	Daphnia magna; Water flea;	NEONATE, <12 H	to 11 D	REP *	11,000	210212	91	
	Daphnia magna; Water flea;	NEONATE, <12 H	to 11 D	REP *	11,000	210212	91	
	Daphnia magna; Water flea;	NEONATE, <12 H	to 11 D	REP *	6,500	210212	91	
	Daphnia magna; Water flea;	NR	24 H	BCF	1.01	212480	75	
	Daphnia magna; Water flea;	NR	24 H	EC_{0}	74	210707	82	
	Daphnia magna; Water flea;	NR	24 H	EC_{100}	286	210707	82	
	Daphnia magna; Water flea;	NR	24 H	EC_{50}	195	210707	82	
	Daphnia magna; Water flea;	NR	24 H	EC_{50}IM	4,300	315526	83	
	Gambusia affinis; Mosquitofish	NR	24 H	BCF	1.01	212480	75	
	Lepomis macrochirus; Bluegill;	3.8-6.4 CM, 1-2 G	24 H	LC_{50}	24,000	210728	66	
	Lepomis macrochirus; Bluegill;	3.8-6.4 CM, 1-2 G	48 H	LC_{50}	24,000	210728	66	
	Lepomis macrochirus; Bluegill;	3.8-6.4 CM, 1-2 G	96 H	LC_{50}	24,000	210728	66	
	Lepomis macrochirus; Bluegill;	JUVENILE, 0.32-1.2 G	24 H	LC_{50}	17,000	215590	81	
	Lepomis macrochirus; Bluegill;	JUVENILE, 0.32-1.2 G	96 H	LC_{50}	16,000	215590	81	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	1 H	LC_{50}	12,000	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	16 H	LC_{50}	6,000	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	2 H	LC_{50}	6,800	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	24 H	LC_{50}	4,500	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	24 H	LC_{50}	6,000	217398	85	

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	24 H	LC_{50}	8,000	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	4 H	LC_{50}	6,000	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	48 H	LC_{50}	4,500	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	48 H	LC_{50}	7,700	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	72 H	LC_{50}	4,500	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	72 H	LC_{50}	7,400	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	8 H	LC_{50}	6,000	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	96 H	LC_{50}	4,500	217398	85	
	Lepomis macrochirus; Bluegill;	JUVENILE, 3.65 CM, 0.90 G	96 H	LC_{50}	7,400	217398	85	
	Micropterus salmoides; Largemouth bass	EGG	6.5 D	LC_{50}	50	210538	79	
	Micropterus salmoides; Largemouth bass	EGG	6.5 D	LC_{50}	60	210538	79	
	Micropterus salmoides; Largemouth bass	EGG	60 H	LC_{50}	660	210538	79	
	Micropterus salmoides; Largemouth bass	EGG	60 H	LC_{50}	710	210538	79	
	Micropterus salmoides; Largemouth bass	EGGS-4 D POST HATCH	7.5 D	LC_{50} *	50	210563	79	
	Micropterus salmoides; Largemouth bass	EGGS-4 D POST HATCH	7.5 D	LC_{50} *	60	210563	79	
	Micropterus salmoides; Largemouth bass	EGGS-4 D POST HATCH	84 H	LC_{50} *	340	210563	79	
	Micropterus salmoides; Largemouth bass	EGGS-4 D POST HATCH	84 H	LC_{50} *	390	210563	79	
	Oedogonium cardiacum; Green algae	NR	48 H	BCF	1.01	212480	75	
	Oncorhynchus mykiss; Rainbow trout	200-400 G	30 D	ENZ *	2,100	315457	82	
	Oncorhynchus mykiss; Rainbow trout	200-400 G	30 D	ENZ *	2,900	315457	82	
	Oncorhynchus mykiss; Rainbow trout	200-400 G	30 D	GRO *	2,100	315457	82	
	Oncorhynchus mykiss; Rainbow trout	200-400 G	30 D	HEM *	2,100	315457	82	
	Oncorhynchus mykiss; Rainbow trout	200-400 G	30 D	MOR *	2,900	315457	82	
	Oncorhynchus mykiss; Rainbow trout	75-200 G	72 H	HEM *	9.8	315457	82	
	Oncorhynchus mykiss; Rainbow trout	75-200 G	96 H	GRO *	9.8	315457	82	
	Oncorhynchus mykiss; Rainbow trout	EGGS-4 D POST HATCH	16 D	LC_{50}	<90	210563	79	
	Oncorhynchus mykiss; Rainbow trout	EGGS-4 D POST HATCH	16 D	LC_{50}	<90	210563	79	
	Oncorhynchus mykiss; Rainbow trout	NR	3 H	ENZ *	1	216433	80	
	Oncorhynchus mykiss; Rainbow trout	NR	48 H	LC_{50}	4,100	315526	83	
	Oncorhynchus mykiss; Rainbow trout	NR	96 H	LC_{50}	4,700	315457	82	
	Oncorhynchus mykiss; Rainbow trout	STD LENGTH, 1.2-3.8 G, 4.6-6.4 CM	96 H	LC_{50} (Calc)	7,460	310688	84	
	Physa sp; Pouch snail;	NR	48 H	BCF	1.01	212480	75	
	Pimephales promelas; Fathead minnow	3.8-6.4 CM, 1-2 G	24 H	LC_{50}	29,120	210728	66	
	Pimephales promelas; Fathead minnow	3.8-6.4 CM, 1-2 G	24 H	LC_{50}	33,930	210728	66	
	Pimephales promelas; Fathead minnow	3.8-6.4 CM, 1-2 G	24 H	LC_{50}	39,190	210728	66	
	Pimephales promelas; Fathead minnow	3.8-6.4 CM, 1-2 G	48 H	LC_{50}	29,120	210728	66	
	Pimephales promelas; Fathead minnow	3.8-6.4 CM, 1-2 G	48 H	LC_{50}	33,930	210728	66	
	Pimephales promelas; Fathead minnow	3.8-6.4 CM, 1-2 G	48 H	LC_{50}	34,980	210728	66	
	Pimephales promelas; Fathead minnow	3.8-6.4 CM, 1-2 G	96 H	LC_{50}	29,120	210728	66	
	Pimephales promelas; Fathead minnow	3.8-6.4 CM, 1-2 G	96 H	LC_{50}	33,930	210728	66	
	Pimephales promelas; Fathead minnow	3.8-6.4 CM, 1-2 G	96 H	LC_{50}	33,930	210728	66	
	Pimephales promelas; Fathead minnow	31 D, 17.8 MM, 0.083 G	96 H	LC_{50}	16,900	213217	90	
	Pimephales promelas; Fathead minnow	FRY, 10-15 D, 11.6 MG, 9.5 MM	96 H	LC_{50}	22,300	310432	83	
	Pimephales promelas; Fathead minnow	JUVENILE, 30-35 D, 76.8 MG, 14.9 MM	96 H	LC_{50}	35,400	310432	83	
	Pimephales promelas; Fathead minnow	SUB-ADULT, 65-94 D, 391 MG, 28 MM	96 H	LC_{50}	22,200	310432	83	
	Poecilia reticulata; Guppy;	2-3 MO	14 D	LC_{50} (Calc)	19,100	216354	81	
	Poecilia reticulata; Guppy;	6 M, 1.9-2.5 CM, 0.1-0.2 G	24 H	LC_{50}	45,530	210728	66	
	Poecilia reticulata; Guppy;	6 M, 1.9-2.5 CM, 0.1-0.2 G	48 H	LC_{50}	45,530	210728	66	
	Poecilia reticulata; Guppy;	6 M, 1.9-2.5 CM, 0.1-0.2 G	96 H	LC_{50}	45,530	210728	66	
Methylene chl[illegible]	Carassius auratus; Goldfish;	NR	24 H	LC_{50}	420,000		215[illegible]	78

Table O.1-9
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration: Lethal	Effect Concentration: Sublethal	AQUIRE Reference Number	Year of Publication
Methylene chloride (cont.)	Daphnia magna; Water flea;	24 H	24 H	LC_{50}	2,270,000		215718	77
	Daphnia magna; Water flea;	6-24 H	24 H	EC_{50}IM		1,959,000	210846	89
	Daphnia magna; Water flea;	6-24 H	48 H	EC_{50}IM		1,682,000	210846	89
	Daphnia magna; Water flea;	<24 H	24 H	LC_{50}	310,000		215184	80
	Daphnia magna; Water flea;	<24 H	48 H	LC_{50}	220,000		215184	80
	Daphnia magna; Water flea;	<24 H	48 H	MOR *	68,000		215184	80
	Daphnia magna; Water flea;	NR	24 H	EC_0		1.707	210707	82
	Daphnia magna; Water flea;	NR	24 H	EC_{100}		2.5	210707	82
	Daphnia magna; Water flea;	NR	24 H	EC_{50}		2.1	210707	82
	Lepomis macrochirus; Bluegill;	JUVENILE, 0.32-1.2 G	24 H	LC_{50}	230,000		215590	81
	Lepomis macrochirus; Bluegill;	JUVENILE, 0.32-1.2 G	96 H	LC_{50}	220,000		215590	81
	Oryzias latipes; Medaka, high-eyes	NR	24 H	LC_{50}	1,100,000		312497	86
	Oryzias latipes; Medaka, high-eyes	NR	24 H	LC_{50}	1,100,000		312497	86
	Oryzias latipes; Medaka, high-eyes	NR	24 H	LC_{50}	840,000		312497	86
	Oryzias latipes; Medaka, high-eyes	NR	48 H	LC_{50}	1,100,000		312497	86
	Oryzias latipes; Medaka, high-eyes	NR	48 H	LC_{50}	1,100,000		312497	86
	Oryzias latipes; Medaka, high-eyes	NR	48 H	LC_{50}	840,000		312497	86
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	24 H	EC_{50}IM		112,800	210973	78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	24 H	LC_{50}	268,000		210973	78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	48 H	EC_{50}IM		99,000	210973	78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	48 H	LC_{50}	265,000		210973	78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	72 H	EC_{50}IM		99,000	210973	78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	72 H	LC_{50}	232,400		210973	78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	96 H	EC_{50}IM		99,000	210973	78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	96 H	LC_{50}	193,000		210973	78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	96 H	LC_{50}	310,000		210973	78
	Pimephales promelas; Fathead minnow	30 D, 17.6 MM, 0.066 G	96 H	LC_{50}	330,000		312858	86
	Pimephales promelas; Fathead minnow	< 24 H, EMBRYO	28 D	GRO *		142,000	312567	87
	Pimephales promelas; Fathead minnow	< 24 H, EMBRYO	28 D	GRO *		82,500	312567	87
	Pimephales promelas; Fathead minnow	JUVENILE	192 H	LC_{50}	471,000		312567	87
	Pimephales promelas; Fathead minnow	JUVENILE	96 H	LC_{50}	502,000		312567	87
	Poecilia reticulata; Guppy	2-3 MO	14 D	LC_{50} (Calc)	294,000		216354	81
Tetrachloroethylene	Daphnia magna; Water flea	NR	24 H	EC_{50}		147,000		82
	Daphnia magna; Water flea	FIRST INSTAR, < 24 H	48 H	EC_{50}IMM		7,500		83
	Daphnia magna; Water flea	<24 H	24 H	LC_{50}	18,000			80
	Daphnia magna; Water flea	FIRST INSTAR, <= 24 H	48 H	EC_{50}IMM		7,490		83
	Daphnia magna; Water flea	FIRST INSTAR, <= 24 H	48 H	LC_{50}	9,090			83
	Daphnia magna; Water flea	NR	24 H	EC_0		65,000		82
	Daphnia magna; Water flea	FIRST INSTAR, <= 24 H	48 H	LC_{50}	18,100			83
	Daphnia magna; Water flea	NR	24 H	EC_{100}		250,000		82
	Daphnia magna; Water flea	FIRST INSTAR, <= 24 H	48 H	EC_{50}IMM		8,500		83
	Daphnia magna; Water flea	FIRST INSTAR, < 24 H	28 D	GRO		1,100		83
	Daphnia magna; Water flea	<24 H	48 H	LC_{50}	18,000			80
	Daphnia magna; Water flea	FIRST INSTAR, < 24 H	28 D	GRO		510		83
	Daphnia magna; Water flea	<24 H	48 H	MOR	10,000			80
	Daphnia magna; Water flea	< 24 H	28 D	GRO		1,110		83
	Daphnia magna; Water flea	FIRST INSTAR, < 24 H	48 H	LC_{50}	18,000			83
	Daphnia magna; Water flea	FIRST INSTAR, < 24 H	28 D	REP		510		83
	Daphnia magna; Water flea	< 24 H	28 D	REP		1,110		83
	Daphnia magna; Water flea	FIRST INSTAR, < 24 H	48 H	LC_{50}	9,100			83

Table O.1−9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
	Daphnia magna; Water flea	FIRST INSTAR, < 24 H	48 H	EC_{50}IMM		8,500		83
	Daphnia magna; Water flea	FIRST INSTAR, < 24 H	28 D	REP		1,100		83
	Lepomis macrochirus; Bluegill	JUVENILE, 0.32−1.2 G	24 H	LC_{50}	46,000			81
	Lepomis macrochirus; Bluegill	JUVENILE, 0.32−1.2 G	96 H	LC_{50}	13,000			81
	Moina macrocopa; Water flea	5 D	3 H	LC_{50}	1,800			86
	Oncorhynchus mykiss; Rainbow trout	7.3 CM, 5.86 G, FINGERLING	24 H	LC_{50}	6,310			83
	Oncorhynchus mykiss; Rainbow trout	6.1 CM, 3.2 G, FINGERLING	72 H	LC_{50}	4,990			83
	Oncorhynchus mykiss; Rainbow trout	6.1 CM, 3.2 G, FINGERLING	24 H	LC_{50}	4,990			83
	Oncorhynchus mykiss; Rainbow trout	6.1 CM, 3.2 G, FINGERLING	48 H	LC_{50}	4,990			83
	Oncorhynchus mykiss; Rainbow trout	7.3 CM, 5.86 G, FINGERLING	96 H	LC_{50}	5,840			83
	Oncorhynchus mykiss; Rainbow trout	7.3 CM, 5.86 G, FINGERLING	72 H	LC_{50}	5,810			83
	Oncorhynchus mykiss; Rainbow trout	7.3 CM, 5.86 G, FINGERLING	48 H	LC_{50}	5,950			83
	Oncorhynchus mykiss; Rainbow trout	6.1 CM, 3.2 G, FINGERLING	96 H	LC_{50}	4,990			83
	Oncorhynchus mykiss; Rainbow trout	3.20 G	96 H	LC_{50}	4,990			82
	Oryzias latipes; Medaka	3 CM, 0.3 G	48 H	LC_{50}	1,600			86
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	96 H	LC_{50}	21,400			78
	Pimephales promelas; Fathead minnow	30−35 D	48 H	LC_{50}	15,900			83
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	72 H	LC_{50}	18,900			78
	Pimephales promelas; Fathead minnow	0.12 G	96 H	LC_{50}	13,500			83
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	72 H	EC_{50}IMM		14,400		78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	48 H	LC_{50}	19,600			78
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	48 H	EC_{50}IMM		14,400		78
Tetrachloroethylene (cont.)	Pimephales promelas; Fathead minnow	30 D	96 H	LC_{50}	13,400			85
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	24 H	LC_{50}	23,500			78
	Pimephales promelas; Fathead minnow	31 D, 20.3 MM, 0.120 G	96 H	LC_{50}	20,300			85
	Pimephales promelas; Fathead minnow	30−35 D	96 H	LC_{50}	13,400			83
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	96 H	EC_{50}IMM		14,400		78
	Pimephales promelas; Fathead minnow	30−35 D	24 H	LC_{50}	17,900			83
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	24 H	EC_{50}IMM		14,400		78
	Pimephales promelas; Fathead minnow	30−35 D	72 H	LC_{50}	14,900			83
	Pimephales promelas; Fathead minnow	1.04 G, 49.0 MM	96 H	LC_{50}	18,400			78
	Tanytarsus dissimilis; Midge	3RD OR 4TH INSTAR, 2.0−3.5 MM	48 H	LC_{50}	30,800			83
	Tanytarsus dissimilis; Midge	3RD OR 4TH INSTAR, 2.0−3.5 MM	24 H	LC_{50}	54,600			83
Toluene	Aedes aegypti; Mosquito;	4TH INSTAR LARVAE	24 H	EC_{50}IM		21,520	215700	77
	Aedes aegypti; Mosquito;	4TH INSTAR LARVAE	24 H	MOR	9,950		215700	77
	Brachionus calyciflorus; Rotifer; Rotifers;	NEONATE	24 H	LC_{50}	113,000		219385	91
	Chlorella vulgaris; Green algae; Chlorophyta;	NR	24 H	EC_{50}GR		245,000	212215	75
	Daphnia magna; Water flea;	1ST INSTAR	48 H	EC_{50}IM		19,600	215087	79
	Daphnia magna; Water flea;	24 H	24 H	LC_{50}	470,000		215718	77
	Daphnia magna; Water flea;	<24 H	24 H	LC_{50}	310,000		215184	80
	Daphnia magna; Water flea;	<24 H	48 H	LC_{50}	310,000		215184	80
	Daphnia magna; Water flea;	<24 H	48 H	MOR	28,000		215184	80
	Daphnia magna; Water flea;	<= 24 H	21 D	REP		$\boxed{1,000}$	210847	89
	Daphnia magna; Water flea;	<= 24 H	24 H	EC_{50}IM		84,000	210847	89
	Daphnia magna; Water flea;	NR	24 H	EC_0		53	216628	88
	Daphnia magna; Water flea;	NR	24 H	EC_0		93	210707	82
	Daphnia magna; Water flea;	NR	24 H	EC_{100}		500	210707	82
	Daphnia magna; Water flea;	NR	24 H	EC_{50}		270	210707	82
	Daphnia magna; Water flea;	NR	24 H	EC_{50}		84	216628	88
	Daphnia magna; Water flea;	NR	24 H	EC_{50}IM		7,000	3131[illegible]	88

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
	Diaptomus forbesi; Calanoid copepod; Copepoda;	NR	96 H	LC_{50}	447,000		311282	83
	Scenedesmus subspicatus; Green algae; Chlorophyta;	LOG GRO PHASE	48 H	EC_{50}BM		160,000	212997	90
	Scenedesmus subspicatus; Green algae; Chlorophyta;	LOG GRO PHASE	48 H	EC_{50}GR		125,000	212997	90
	Selenastrum capricornutum; Green algae; Chlorophyta;	EXPO GRO PHASE	8 D	EC_{50}GR		9,400	213550	90
	Selenastrum capricornutum; Green algae; Chlorophyta;	NR	72 H	EC_{50}GR		12,500	313142	88
1,1,2-Trichloroethylene	Aedes aegypti, mosquito	3RD INSTAR	48 H	LC_{50}	48,000			83
	Ambystoma mexicanum, salamander	3-4 WK	48 H	LC_{50}	48,000			80
	Asellus aquaticus, sowbug	NR	48 H	LC_{50}	30,000			83
	Brachydanio rerio, zebrafish	NR	48 H	LC_{50}	60,000			79
	Chironomus thummi, midge	NR	48 H	LC_{50}	64,000			83
	Cloeon dipterum, mayfly	NR	48 H	LC_{50}	42,000			83
	Corixa punctata, water boatman	NR	48 H	LC_{50}	110,000			83
	Culex pipiens, mosquito	3RD INSTAR	48 H	LC_{50}	55,000			83
	Daphnia magna, water flea	<=24 H	48 H	LC_{50}	18,000			80
	Daphnia magna, water flea	NR	3 D	ABD	25,000			84
	Daphnia magna, water flea	24 H	24 H	LC_{50}	1,000,000			77
	Daphnia magna, water flea	NR	24 H	leth	110,000			84
	Daphnia magna, water flea	NR	24 H	EC_{50}	1,313,000			82
	Daphnia magna, water flea	<=24 H	24 H	LC_{50}	22,000			80
	Daphnia magna, water flea	<=24 H	48 H		2,200			80
	Dugesia lugubris, flatworm	NR	48 H	LC_{50}	42,000			83
	Erpobdella octoculata, leech	NR	48 H	LC_{50}	75,000			83
	Gammarus pulex, scud	NR	48 H	LC_{50}	24,000			83
	Hydra oligactis, hydra	BUDLESS	48 H	LC_{50}	75,000			83
	Hydra oligactis, hydra	NR	48 H	LC_{50}	75,000			83
	Ischnura elegans, dragonfly	NR	48 H	LC_{50}	49,000			83
	Lepomis macrochirus, bluegill	JUVENILE 75 D, 2.2 CM	1 H	RES	100			90
	Lepomis macrochirus, bluegill	JUVENILE, 0.32-1.2 G	96 H	LC_{50}	45,000			81
	Lepomis macrochirus, bluegill	JUVENILE, 0.32-1.2 G	24 H	LC_{50}	68,000 to 100,000			81
	Lymnaea stagnalis, great pond snail	3-4 WK	48 H	LC_{50}	56,000			83
	Lymnaea stagnalis, great pond snail	NR	48 H	LC_{50}	56,000			83
	Moina macrocopa, water flea	5 D	3 H	LC_{50}	2,300			86
	Nemoura cinerea, stonefly	NR	48 H	LC_{50}	70,000			83
	Oncorhynchus mykiss, rainbow trout	NR	24 H	RES	5,000			79
	Oncorhynchus mykiss, rainbow trout	5-8 WK	48 H	LC_{50}	42,000			83
	Oryzias latipes, medaka	3 CM, 0.3 G	48 H	LC_{50}	1,900			86
	Oryzias latipes, medaka	4-5 WK	48 H	LC_{50}	270,000			83
	Pimephales promelas, fathead minnow	1.04 G, 49.0 MM	48 H	IMM	22,700			78
	Pimephales promelas, fathead minnow	31 D	96 H	LC_{50}	44,100			85
	Pimephales promelas, fathead minnow	30-35 D	24 H	LC_{50}	58,800			83
	Pimephales promelas, fathead minnow	3-4 WK	48 H	LC_{50}	47,000			83
	Pimephales promelas, fathead minnow	1.04 G, 49.0 MM	96 H	IMM	21,900			78
	Pimephales promelas, fathead minnow	30-35 D	48 H	LC_{50}	57,900			83
	Pimephales promelas, fathead minnow	1.04 G, 49.0 MM	72 H	IMM	22,200			78
1,1,2-Trichloroethylene (cont.)	Pimephales promelas, fathead minnow	1.04 G, 49.0 MM	24 H	LC_{50}	52,400			78
	Pimephales promelas, fathead minnow	30-35 D	96 H	LC_{50}	45,000			83
	Pimephales promelas, fathead minnow	1.04 G, 49.0 MM	24 H	IMM	23,000			78
	Pimephales promelas, fathead minnow	0.12 G	96 H	LC_{50}	44,100			83
	Pimephales promelas, fathead minnow	30-35 D	72 H	LC_{50}	55,400			83
	Pimephales promelas, fathead minnow	1.04 G; 49.0 MM	96 H	LC_{50}	66,800			78

Table O.1–9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
	Pimephales promelas, fathead minnow	1.04 G, 49.0 MM	96 H	LC_{50}	40,700			78
	Pimephales promelas, fathead minnow	1.04 G, 49.0 MM	72 H	LC_{50}	39,000			78
	Pimephales promelas, fathead minnow	1.04 G, 49.0 MM	48 H	LC_{50}	53,300			78
	Scenedesmus abundans, green algae	10E4 CELLS/ML	96 H	GRO	450,000			85
	Selenastrum capricornutum, green algae	LOG PHASE	96 H	PGR	175,000			83
	Tubificidae, tubificidae	NR	48 H	LC_{50}	132,000			83
	Xenopus laevis, clawed toad	3–4 WK	48 H	LC_{50}	45,000			80
PAL Semivolatile Organics								
Bis(2–ethylhexyl)phthalate	Anacystis aeruginosa; Blue–green algae;	LOG–PHASE 500000 CELLS/ML	96 H	EC_{50}GR		>=320	215336	81
	Anacystis aeruginosa; Blue–green algae;	LOG–PHASE 500000 CELLS/ML	96 H	PGR *		>=320	215336	81
	Brachydanio rerio; Zebra danio, zebrafish;	4–5 WK	96 H	LC_{50}	>320		215390	84
	Brachydanio rerio; Zebra danio, zebrafish;	4–5 WK	96 H	MOR *	>=320		215390	84
	Brachydanio rerio; Zebra danio, zebrafish;	<4 H, EGGS	5 WK	DVP *		>=1000	215390	84
	Brachydanio rerio; Zebra danio, zebrafish;	1–2 D	96 H	MOR *	>=320		215390	84
	Brachydanio rerio; Zebra danio, zebrafish;	<4 H, EGGS	5 WK	GRO *		>=1000	215390	84
	Brachydanio rerio; Zebra danio, zebrafish;	1–2 D	96 H	BEH *		>=320	215390	84
	Brachydanio rerio; Zebra danio, zebrafish;	4–5 WK	96 H	BEH *		>=320	215390	84
	Brachydanio rerio; Zebra danio, zebrafish;	1–2 D	96 H	LC_{50}	>320		215390	84
	Brachydanio rerio; Zebra danio, zebrafish;	<4 H, EGGS	5 WK	MOR *	>=1000		215390	84
	Bufo woodhousei fowleri; Fowler's toad;	EMBRYO TO LARVA	to 8 D *	LC_{50}	3,880		216772	78
	Bufo woodhousei fowleri; Fowler's toad;	LARVA	96 H *	LC_{50}	3,880		216772	78
	Carassius auratus; Goldfish;	EMBRYO TO LARVA	96 H *	LC_{50}	6,180		216772	78
	Carassius auratus; Goldfish;	EGGS, 4 D POSTHATCH	96 H	LC_{50} *	> 191000		210563	79
	Carassius auratus; Goldfish;	EGGS, 4 D POSTHATCH	96 H	LC_{50} *	> 186000		210563	79
	Carassius auratus; Goldfish;	EGGS, 4 D POSTHATCH	8 D	LC_{50} *	> 191000		210563	79
	Carassius auratus; Goldfish;	EGGS, 4 D POSTHATCH	8 D	LC_{50} *	> 186000		210563	79
	Chironomus plumosus; Midge;	EGG	30 D	HAT *		560	217688	77
	Chironomus plumosus; Midge;	LARVAE	30 D	DVP *		560	217688	77
	Chlorella pyrenoidosa; Green algae;	LOG–PHASE 10000 CELLS/ML	96 H	EC_{50}GR		>320	215336	81
	Chlorella pyrenoidosa; Green algae;	LOG–PHASE 10000 CELLS/ML	96 H	PGR *		>=320	215336	81
	Daphnia magna; Water flea;	<24 H	24 H	LC_{50}	>68000		215184	80
	Daphnia magna; Water flea;	NR	21 D	REP *		10	210736	73
	Daphnia magna; Water flea;	< 24 H	21 D	MOR *	10		311061	82
	Daphnia magna; Water flea;	NR	21 D	REP *		2.5	210736	73
	Daphnia magna; Water flea;	< 24 H	21 D	MOR *	3.2		311061	82
	Daphnia magna; Water flea;	NR	21 D	REP *		3	210736	73
	Daphnia magna; Water flea;	< 24 H	48 H	LOC *		47	311061	82
	Daphnia magna; Water flea;	NR	21 D	REP *		30	210736	73
	Daphnia magna; Water flea;	<1 D	2 WK	MOR *	32		215336	81
	Daphnia magna; Water flea;	FIRST INSTAR, < 24 H	7 D	BIO *		811	312340	87
	Daphnia magna; Water flea;	FIRST INSTAR, < 24 H	7 D	MOR *	158		312340	87
	Daphnia magna; Water flea;	<1 D	3 WK	LC_{50}	>320		215336	81
	Daphnia magna; Water flea;	FIRST INSTAR, < 24 H	7 D	MOR *	811		312340	87
	Daphnia magna; Water flea;	<24 H	2 WK	REP *		320	215336	81
Bis(2–ethylhexyl)phthalate	Daphnia magna; Water flea;	NR	14 D	REP *		10	210736	73
(cont.)	Daphnia magna; Water flea;	<24 H	48 H	LC_{50}	11,000		215184	80
	Daphnia magna; Water flea;	NR	14 D	REP *		3	210736	73
	Daphnia magna; Water flea;	FIRST INSTAR, < 24 H	21 D	MOR *	158		312340	87
	Daphnia magna; Water flea;	NR	14 D	REP *		30	210736	73
	Daphnia magna; Water flea;	FIRST INSTAR, < 24 H	7 D	BIO *		158	312340	87

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
	Daphnia magna; Water flea;	< 24 H	21 D	MOR *	100		311061	82
	Daphnia magna; Water flea;	<1 D	3 WK	MOR *	>=320		215336	81
	Daphnia magna; Water flea;	< 24 H	21 D	MOR *	32		311061	82
	Daphnia magna; Water flea;	<24 H	48 H	MOR *	1,100		215184	80
	Daphnia magna; Water flea;	<1 D	2 WK	LC_{50}	>320		215336	81
	Daphnia magna; Water flea;	<1 D	24 H	EC_{50}IM		>320	215336	81
	Daphnia magna; Water flea;	FIRST INSTAR, < 24 H	21 D	MOR *	811		312340	87
	Daphnia magna; Water flea;	1ST INSTAR, 24 H	21 D	REP		3	210732	73
	Daphnia magna; Water flea;	<1 D	2 WK	MOR *	>=320		215336	81
	Daphnia pulex; Water flea;	NEONATE, < 24 H	48 H	EC_{50}IM		133	312730	87
	Euglena gracilis; Flagellate euglenoid;	LOG-PHASE 10000 CELLS/ML	96 H	EC_{50}GR		>320	215336	81
	Euglena gracilis; Flagellate euglenoid;	LOG-PHASE 10000 CELLS/ML	96 H	PGR *		>=320	215336	81
	Gammarus pseudolimnaeus; Scud;	NR	96 H	LC_{50}	>32000		210732	73
	Gammarus pseudolimnaeus; Scud;	JUVENILE	96 H	LC_{50}	> 32000		210666	80
	Gammarus pulex; Scud;	>12 MM	10 D	LOC *		100	210079	91
	Gammarus pulex; Scud;	>12 MM	10 D	LOC *		500	210079	91
	Gasterosteus aculeatus; Three spine stickleback;	4-5 WK	48 H	LC_{50}	> 300		210823	89
	Gasterosteus aculeatus; Three spine stickleback;	4-5 WK	96 H	LC_{50}	> 300		210823	89
	Gasterosteus aculeatus; Three spine stickleback;	4-5 WK	24 H	LC_{50}	> 300		210823	89
	Gasterosteus aculeatus; Three spine stickleback;	EGGS, < 6 H	35 D	EC_{50} *		> 320	210823	89
	Gasterosteus aculeatus; Three spine stickleback;	4-5 WK	24 H	EC_{50} *		> 300	210823	89
	Gasterosteus aculeatus; Three spine stickleback;	EGGS, < 6 H	35 D	LC_{50}	> 320		210823	89
	Gasterosteus aculeatus; Three spine stickleback;	4-5 WK	72 H	LC_{50}	> 300		210823	89
	Gasterosteus aculeatus; Three spine stickleback;	4-5 WK	48 H	EC_{50} *		> 300	210823	89
	Gasterosteus aculeatus; Three spine stickleback;	4-5 WK	72 H	EC_{50} *		> 300	210823	89
	Gasterosteus aculeatus; Three spine stickleback;	4-5 WK	96 H	EC_{50} *		> 300	210823	89
	Ictalurus punctatus; Channel catfish;	1.5 G	96 H	LC_{50}	> 100000		210666	80
	Ictalurus punctatus; Channel catfish;	EMBRYO TO LARVA	96 H *	LC_{50}	690		216772	78
	Jordanella floridae; Flagfish;	28-35 D	3 WK	MOR *	>=320		215336	81
	Jordanella floridae; Flagfish;	<36 H	4 WK	MOR *	>=320		215336	81
	Jordanella floridae; Flagfish;	<36 H	7 D	LC_{50}	>320		215336	81
	Jordanella floridae; Flagfish;	1-2 D	96 H	LC_{50}	>320		215336	81
	Jordanella floridae; Flagfish;	4-5 WK	96 H	BEH *		>=320	215336	81
	Jordanella floridae; Flagfish;	4-5 WK	96 H	LC_{50}	>320		215336	81
	Jordanella floridae; Flagfish;	1-2 D	48 H	LC_{50}	>320		215336	81
	Jordanella floridae; Flagfish;	<36 H	4 WK	GRO *		>=320	215336	81
	Jordanella floridae; Flagfish;	28-35 D	4 WK	MOR *	>=320		215336	81
	Jordanella floridae; Flagfish;	<36 H	4 WK	LC_{50}	>320		215336	81
	Jordanella floridae; Flagfish;	4-5 WK	48 H	LC_{50}	>320		215336	81
	Jordanella floridae; Flagfish;	1-2 D	96 H	BEH *		>=320	215336	81
	Jordanella floridae; Flagfish;	28-35 D	4 WK	GRO *		>=320	215336	81
	Jordanella floridae; Flagfish;	28-35 D	2 WK	MOR *	>=320		215336	81
	Jordanella floridae; Flagfish;	28-35 D	4 WK	REP *		>=320	215336	81
	Jordanella floridae; Flagfish;	28-35 D	1 WK	MOR *	>=320		215336	81
	Lepomis macrochirus; Bluegill;	0.32-1.2 G, JUVENILE	24 H	LC_{50}	>770000		215590	81
Bis(2-ethylhexyl)phthalate (cont.)	Lepomis macrochirus; Bluegill;	0.32-1.2 G, JUVENILE	96 H	LC_{50}	>770000		215590	81
	Lepomis macrochirus; Bluegill;	0.6 G	96 H	LC_{50}	> 100000		210666	80
	Lepomis macrochirus; Bluegill;	JUVENILE, 35 - 60 MM	0.7 H	AVO *		112,400	215272	80
	Micropterus salmoides; Largemouth bass;	EGGS, 4 D POSTHATCH	84 H	LC_{50} *	32,100		210563	79
	Micropterus salmoides; Largemouth bass;	EMBRYO TO LARVA	96 H *	LC_{50}	32,900		216772	78
	Micropterus salmoides; Largemouth bass;	EMBRYO TO LARVA	96 H *	LC_{50}	42,100		216772	78

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
	Micropterus salmoides; Largemouth bass;	EGGS, 4 D POSTHATCH	7.5 D	LC_{50} *	45,500		210563	79
	Micropterus salmoides; Largemouth bass;	EGGS, 4 D POSTHATCH	7.5 D	LC_{50} *	55,700		210563	79
	Micropterus salmoides; Largemouth bass;	EGGS, 4 D POSTHATCH	84 H	LC_{50} *	65,500		210563	79
	Oncorhynchus kisutch; Coho salmon, silver salmon;	1.5 G	96 H	LC_{50}	> 100000		210666	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	12 D *	MOR *	54		217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	100 D	HAT *		54	217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	12 D *	MOR *	14		217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EGGS, 4 D POSTHATCH	23 D	LC_{50} *	154,000		210563	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	12 D *	MOR *	5		217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EGGS, 4 D POSTHATCH	27 D	LC_{50} *	149,200		210563	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	1.5 G	96 H	LC_{50}	> 100000		210666	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EMBRYO TO LARVA	96 H *	LC_{50}	149,200		216772	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	24 D *	MOR *	14		217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGG	90 D	VTE *		14	215109	77
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	24 D *	MOR *	5		217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	100 D	GRO *		62	217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	24 D *	MOR *	54		217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EGGS, 4 D POSTHATCH	27 D	LC_{50} *	139,500		210563	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	5 D *	MOR *	14		217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGG	90 D	GRO *		54	215109	77
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	5 D *	MOR *	5		217859	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EGGS, 4 D POSTHATCH	23 D	LC_{50} *	139,100		210563	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGG	90 D	VTE *		5	215109	77
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EMBRYO TO LARVA	96 H *	LC_{50}	139,500		216772	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EYED EGGS	5 D *	MOR *	54		217859	76
	Oryzias latipes; Medaka, high-eyes;	28-35 D	4 WK	GRO *		> =320	215336	81
	Oryzias latipes; Medaka, high-eyes;	28-35 D	4 WK	REP *		> =320	215336	81
	Oryzias latipes; Medaka, high-eyes;	1-2 D	96 H	BEH *		> =320	215336	81
	Oryzias latipes; Medaka, high-eyes;	4-5 WK	48 H	LC_{50}	>320		215336	81
	Oryzias latipes; Medaka, high-eyes;	28-35 D	1 WK	MOR *	> =320		215336	81
	Oryzias latipes; Medaka, high-eyes;	4-5 WK	96 H	BEH *		> =320	215336	81
	Oryzias latipes; Medaka, high-eyes;	28-35 D	3 WK	MOR *	> =320		215336	81
	Oryzias latipes; Medaka, high-eyes;	4-5 WK	96 H	LC_{50}	>320		215336	81
	Oryzias latipes; Medaka, high-eyes;	28-35 D	4 WK	LC_{50}	>320		215336	81
	Oryzias latipes; Medaka, high-eyes;	<36 H	4 WK	LC_{50}	>320		215336	81
	Oryzias latipes; Medaka, high-eyes;	1-2 D	96 H	LC_{50}	>320		215336	81
	Oryzias latipes; Medaka, high-eyes;	<36 H	4 WK	MOR *	> =320		215336	81
	Oryzias latipes; Medaka, high-eyes;	1-2 D	48 H	LC_{50}	>320		215336	81
	Oryzias latipes; Medaka, high-eyes;	28-35 D	2 WK	MOR *	> =320		215336	81
	Oryzias latipes; Medaka, high-eyes;	28-35 D	4 WK	MOR *	> =320		215336	81
	Oryzias latipes; Medaka, high-eyes;	<36 H	7 D	LC_{50}	>320		215336	81
	Pimephales promelas; Fathead minnow;	7.5 MO, 1.24 G	56 D	MOR *	62		217859	76
	Pimephales promelas; Fathead minnow;	7.5 MO, 1.24 G	56 D	GRO *		62	217859	76
	Pimephales promelas; Fathead minnow;	FRY, 10 D	127 D	GRO *		100	215109	77
	Pimephales promelas; Fathead minnow;	FRY, 10 D	127 D	VTE *		11	215109	77
Bis(2-ethylhexyl)phthalate	Poecilia reticulata; Guppy;	21-28 D	2 WK	LC_{50}	>320		215336	81
(cont.)	Poecilia reticulata; Guppy;	21-28 D	48 H	LC_{50}	>320		215336	81
	Poecilia reticulata; Guppy;	21-28 D	4 WK	LC_{50}	>320		215336	81
	Poecilia reticulata; Guppy;	21-28 D	1 WK	LC_{50}	>320		215336	81
	Rana arvalis; Moorfrog;	EGGS	3 WK	HAT		$\boxed{0.89 \text{ to } 187.40}$	215904	87
	Rana pipiens; Leopard frog;	EMBRYO TO LARVA	to 8 D *	LC_{50}	4,440		21677[illegible]	78

Table O.1–9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
	Rana pipiens; Leopard frog;	LARVA	96 H *	LC_{50}	4,440		216772	78
	Salvelinus fontinalis; Brook trout;	ADULT, 1.5 YR	150 D	GRO *		52	215109	77
	Salvelinus fontinalis; Brook trout;	ADULT, 1.5 YR	150 D	VTE *		3.7	215109	77
	Selenastrum capricornutum; Green algae;	LOG–PHASE 50000 CELLS/ML	96 H	$EC_{50}GR$		>320	215336	81
	Selenastrum capricornutum; Green algae;	LOG–PHASE 50000 CELLS/ML	96 H	PGR *		>=320	215336	81
	Stephanodiscus hantzschii; Diatom;	LOG–PHASE 10000 CELLS/ML	96 H	$EC_{50}GR$		>320	215336	81
	Stephanodiscus hantzschii; Diatom;	LOG–PHASE 10000 CELLS/ML	96 H	PGR *		>=320	215336	81
PAL Metals								
Aluminum	Brachionus calyciflorus; Rotifer;	NEONATE	24 H	LC_{50}	> 3,000		219385	91
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	$EC_{50}GR$ *		12,700	212262	74
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	$EC_{50}BM$ *		7,600	212262	74
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	$EC_{50}BM$ *		2,500	212262	74
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	$EC_{50}GR$ *		5,100	212262	74
	Salmo trutta; Brown trout;	ALEVIN	28 D	LC_{50}	19		213472	90
	Salmo trutta; Brown trout;	ALEVIN	42 D	LC_{50}	72		213472	90
	Salmo trutta; Brown trout;	ALEVIN	21 D	LC_{50}	84 to 105		213472	90
	Salmo trutta; Brown trout;	ALEVIN	42 D	LC_{50}	15		213472	90
	Salmo trutta; Brown trout;	ALEVIN	28 D	LC_{50}	79		213472	90
	Salmo trutta; Brown trout;	FERT EGG	<4 MO	HAT		<677	213472	90
	Salvelinus fontinalis; Brook trout;	FRY	43.2 H	LT_{50}	1,000		216632	80
	Salvelinus fontinalis; Brook trout;	FRY	7.3 D	LT_{50}	630		216632	80
	Salvelinus fontinalis; Brook trout;	FRY	79.2 H	LT_{50}	500		216632	80
	Salvelinus fontinalis; Brook trout;	ADULT, 25–30 CM	5 D	LET	320		216632	80
	Salvelinus fontinalis; Brook trout;	FRY	86.4 H	LT_{50}	1,000		216632	80
	Salvelinus fontinalis; Brook trout;	FRY	11.5 D	LT_{50}	100		216632	80
	Salvelinus fontinalis; Brook trout;	FRY, 22–23 MM	10.67 D	LT_{50}	480		216188	80
	Salvelinus fontinalis; Brook trout;	FRY	4.7 D	LT_{50}	650		216632	80
	Salvelinus fontinalis; Brook trout;	FRY, 22–23 MM	19.67 D	LT_{50}	470		216188	80
	Salvelinus fontinalis; Brook trout;	FRY	5 D	LT_{50}	1,000		216632	80
	Salvelinus fontinalis; Brook trout;	FRY, 22–23 MM	20.83 D	LT_{50}	20		216188	80
	Salvelinus fontinalis; Brook trout;	FRY	50.4 H	LT_{50}	500		216632	80
	Salvelinus fontinalis; Brook trout;	FRY, 22–23 MM	4.79 D	LT_{50}	42		216188	80
	Salvelinus fontinalis; Brook trout;	FRY	67.2 H	LT_{50}	500		216632	80
	Salvelinus fontinalis; Brook trout;	FRY, 22–23 MM	8.42 D	LT_{50}	500		216188	80
	Salvelinus fontinalis; Brook trout;	EYED EGGS	5 D	MOR *	320		216632	80
	Salvelinus fontinalis; Brook trout;	FRY, 22–23 MM	>20.83 D	LT_{50}	10		216188	80
	Salvelinus fontinalis; Brook trout;	0.2 G, 30 D	3 D	GRO *		268	213592	91
	Salvelinus fontinalis; Brook trout;	FRY, 22–23 MM	>20.83 D	LT_{50}	500		216188	80
	Salvelinus fontinalis; Brook trout;	FRY	55.2 H	LT_{50}	500		216632	80
	Salvelinus fontinalis; Brook trout;	FRY, 22–23 MM	>20.83 D	LT_{50}	500		216188	80
	Salvelinus fontinalis; Brook trout;	FRY	38.4 H	LT_{50}	500		216632	80
	Salvelinus fontinalis; Brook trout;	0.2 G, 30 D	56 D	MOR *	268		213592	91
	Salvelinus fontinalis; Brook trout;	FRY	5.2 D	LT_{50}	100		216632	80
	Salvelinus fontinalis; Brook trout;	RECENTLY HATCHED FRY	5 D	LET	320		216632	80
Aluminum (cont.)	Salvelinus fontinalis; Brook trout;	YEARLINGS, 13–17 CM	5 D	LET	320		216632	80
Aluminum chloride	Ambystoma opacum; Marbled salamander;	EGGS	8 D	LC_{50}	2,280		216199	78
	Brachydanio rerio; Zebra danio, zebrafish;	LARVAE, 7–8 D POST–SPAWN	48 H	LC_{50}	106,000		311199	85
	Brachydanio rerio; Zebra danio, zebrafish;	LARVAE, 7–8 D POST–SPAWN	48 H	LC_{50}	80,000		311199	85
	Carassius auratus; Goldfish;	EGGS	7 D	LC_{50} *	150		215305	78
	Chilomonas paramecium; Cryptomonad;	NR	0.17 H	LET	2,400		212863	73

Table O.1–9
AQUIRE Freshwater Toxicity Information (µg/L)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration: Lethal	Effect Concentration: Sublethal	AQUIRE Reference Number	Year of Publication
	Cyprinus carpio; Common, mirror, colored, carp;	7.5–8.5 CM, 10.5–12.5 G	24 H	MOR *	8,000		315166	81
	Cyprinus carpio; Common, mirror, colored, carp;	7.5–8.5 CM, 10.5–12.5 G	48 H	MOR *	2,000		315166	81
	Cyprinus carpio; Common, mirror, colored, carp;	7.5–8.5 CM, 10.5–12.5 G	24 H	MOR *	4,000		315166	81
	Cyprinus carpio; Common, mirror, colored, carp;	7.5–8.5 CM, 10.5–12.5 G	48 H	MOR *	2,000		315166	81
	Cyprinus carpio; Common, mirror, colored, carp;	7.5–8.5 CM, 10.5–12.5 G	24 H	MOR *	8,000		315166	81
	Cyprinus carpio; Common, mirror, colored, carp;	7.5–8.5 CM, 10.5–12.5 G	48 H	MOR *	8,000		315166	81
	Daphnia magna; Water flea;	12 H	21 D	EC_{50}IM ?		1,400	212022	72
	Daphnia magna; Water flea;	4 H	64 H	EC_{50}IM (Calc)		1,400	212054	48
	Daphnia magna; Water flea;	12 H	48 H	EC_{50}IM ?		3,900	212022	72
	Daphnia magna; Water flea;	12 H	21 D	EC_{50}RE ?		680	212022	72
	Euglena gracilis; Flagellate euglenoid;	NR	3 H	MOR *	1,000,000		212863	73
	Gambusia affinis; Mosquitofish; Poeciliidae;	ADULT, FEMALE	48 H	LC_{50} ? (Calc)	27,500		210508	57
	Gambusia affinis; Mosquitofish; Poeciliidae;	ADULT, FEMALE	24 H	LC_{50} ? (Calc)	29,600		210508	57
	Gambusia affinis; Mosquitofish; Poeciliidae;	ADULT, FEMALE	96 H	LC_{50} ? (Calc)	27,100		210508	57
	Gambusia affinis; Mosquitofish; Poeciliidae;	ADULT, FEMALE	96 H	MOR * (Calc)	20,400		210508	57
	Microhyla carolinensis; Narrow mouthed frog;	EGGS	7 D	LC_{50} *	$\boxed{50}$		215305	78
	Micropterus salmoides; Largemouth bass;	EGGS	8 D	LC_{50}	170		216199	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EGGS	28 D	LC_{50} *	560		215305	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 6 WK	9.25 D	PHY *		5,140; 1,570	218830	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EGGS	28 D	LC_{50}	560		216199	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 6 MO	45 D	PHY *		514; 514	218830	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 11 WK	43.9 D	LT_{50}	513		219328	71
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 6 WK	4.7 D	PHY *		5,200; 5,050	218830	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 6 MO	31.96 D	LT_{50}	5,230		219328	71
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 6 WK	7.46 D	LT_{50}	5,140		219328	71
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 6 MO	45 D	GRO *		51.6; 51.6	218830	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 6 WK	71.52 H	LT_{50}	5,200		219328	71
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 11 WK	45 D	GRO *		513	219328	71
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 6 MO	45 D	GRO *		514	219328	71
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 6 MO	45 D	GRO *		51.6	219328	71
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 11 WK	38.9 D	LT_{50}	5,140		219328	71
	Peranema trichophorum; Flagellate;	NR	0.17 H	LET	>1,000,000		212863	73
	Pimephales promelas; Fathead minnow;	LARVAE, <24 H	14 D	GRO *		66; 35	213070	89
	Pimephales promelas; Fathead minnow;	EMBRYO	4 D	HAT *		66; 35	213070	89
	Pimephales promelas; Fathead minnow;	30 D	to 109 D	HIS		30 to 60	213182	90
	Pimephales promelas; Fathead minnow;	12 D LARVAE	to 96 H	MOR	50 to 400		210836	89
	Pimephales promelas; Fathead minnow;	JUVENILE	to 96 H	MOR	50 to 400		210836	89
	Pimephales promelas; Fathead minnow;	1 D LARVAE	to 96 H	MOR	50 to 400		210836	89
	Pimephales promelas; Fathead minnow;	LARVAE, <24 H	14 D	MOR *	66; 35		213070	89
	Pimephales promelas; Fathead minnow;	ADULT	2 MO	REP *		66; 35	213070	89
	Tetrahymena pyriformis; Ciliate;	NR	0.17 H	LET	3,200		212863	73
	Tropisternus lateralis; Beetle;	ADULT	14 D	PHY * (Calc)		27,000	212868	69
Aluminum sulfate	Asellus aquaticus; Aquatic sowbug;	ADULT, 7 MM, 1.5 MG DRY WT	48 H	EC_{50}IM ?		6,570	311972	86
	Asellus aquaticus; Aquatic sowbug;	ADULT, 7 MM, 1.5 MG DRY WT	72 H	EC_{50}IM ?		4,370	311972	86
	Biomphalaria glabrata; Snail;	ADULT, 4–4.5 SUTURE WHORL	24 H	STR *		100	212853	63
Aluminum sulfate (cont.)	Biomphalaria glabrata; Snail;	ADULT, 4–4.5 SUTURE WHORL	24 H	STR *		1,000	212853	63
	Cladocera; Water flea order;	NR	2 MO *	POP *		500	217183	78
	Crangonyx pseudogracilis; Amphipod;	ADULT, 4 MM, 0.2 MG DRY WT	48 H	EC_{50}IM ?		12,800	311972	86
	Crangonyx pseudogracilis; Amphipod;	ADULT, 4 MM, 0.2 MG DRY WT	96 H	EC_{50}IM ?		9,190	311972	86
	Crustacea; Crustacean class;	NR	2 MO *	ABD *		500	217183	78
	Cyprinus carpio; Common, mirror, colored, carp;	7.5–8.5 CM, 10.5–12.5 G	24 H	MOR *	8,000		3151[illegible]	81

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration: Lethal	Effect Concentration: Sublethal	AQUIRE Reference Number	Year of Publication
	Cyprinus carpio; Common, mirror, colored, carp;	7.5-8.5 CM, 10.5-12.5 G	24 H	MOR *	8,000		315166	81
	Cyprinus carpio; Common, mirror, colored, carp;	7.5-8.5 CM, 10.5-12.5 G	48 H	MOR *	2,000		315166	81
	Cyprinus carpio; Common, mirror, colored, carp;	7.5-8.5 CM, 10.5-12.5 G	48 H	MOR *	4,000		315166	81
	Cyprinus carpio; Common, mirror, colored, carp;	7.5-8.5 CM, 10.5-12.5 G	48 H	MOR *	4,000		315166	81
	Cyprinus carpio; Common, mirror, colored, carp;	7.5-8.5 CM, 10.5-12.5 G	48 H	MOR *	8,000		315166	81
	Daphnia magna; Water flea;	8 H, YOUNG	0.25 H *	LOC *		136,000	212171	44
	Fundulus heteroclitus; Mummichog;	NR	36 H	LC_{100} (Calc)	2,200		212865	15
	Fundulus heteroclitus; Mummichog;	NR	5 D	LC_{100} (Calc)	1,100		212865	15
	Gambusia affinis; Mosquitofish;	ADULT, FEMALE	24 H	LC_{50} ? (Calc)	69,000		210508	57
	Gambusia affinis; Mosquitofish;	ADULT, FEMALE	48 H	LC_{50} ? (Calc)	38,000		210508	57
	Gambusia affinis; Mosquitofish;	ADULT, FEMALE	48 H	MOR * (Calc)	< 28,000		210508	57
	Gambusia affinis; Mosquitofish;	ADULT, FEMALE	96 H	LC_{50} ? (Calc)	37,000		210508	57
	Micropterus dolomieui; Smallmouth bass;	13.8(12-17) MM, 32.5(9-59) MG	30 D	GRO *		251.6	312723	87
	Micropterus dolomieui; Smallmouth bass;	LARVAE	30 D	MOR *	251.6		312723	87
	Micropterus dolomieui; Smallmouth bass;	LARVAE, 48 H POST-HATCH	96 H	MOR *	100		312723	87
	Micropterus dolomieui; Smallmouth bass;	LARVAE, 48 H POST-HATCH	96 H	MOR *	196		312723	87
	Micropterus dolomieui; Smallmouth bass;	LARVAE, 48 H POST-HATCH	96 H	MOR *	217		312723	87
	Micropterus dolomieui; Smallmouth bass;	LARVAE, 48 H POST-HATCH	96 H	MOR *	32		312723	87
	Micropterus dolomieui; Smallmouth bass;	LARVAE, 48 H POST-HATCH	96 H	MOR *	320		312723	87
	Micropterus dolomieui; Smallmouth bass;	LARVAE, 48 H POST-HATCH	96 H	MOR *	56		312723	87
	Micropterus dolomieui; Smallmouth bass;	LARVAE, 48 H POST-HATCH	96 H	MOR *	560		312723	87
	Notemigonus crysoleucas; Golden shiner;	NR	45 D	MOR *	100,000		312756	86
	Notemigonus crysoleucas; Golden shiner;	NR	45 D	MOR *	100,000		312756	86
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	24 H	MOR *	910		212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	24 H	MOR *	9,100		212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	48 H	LET	9,100		212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	48 H	MOR *	910		212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	72 H	MOR *	910		212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	96 H	HEM *		90	212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	96 H	HEM *		910	212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	96 H	HEM *		910	212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	96 H	MOR *	90		212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	118-355 G, 22-31 CM FORK LENGTH	96 H	MOR *	910		212508	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	50-80 MM	10 D	LC0	200,000		216520	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	50-80 MM	10 D	LC0	50,000		216520	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	50-80 MM	42 H	LC_{100}	50,000		216520	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	50-80 MM	42 H	LC_{100}	50,000		216520	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	50-80 MM	96 H	MOR *	50,000		216520	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 11 WK	45 D	PHY *		513	218830	73
	Salvelinus fontinalis; Brook trout;	14 MO, 210 MM, 130 G	24 H	LC_{50} ?	4,000		216115	75
	Salvelinus fontinalis; Brook trout;	14 MO, 210 MM, 130 G	24 H	LC_{50} ?	4,450		216115	75
	Salvelinus fontinalis; Brook trout;	14 MO, 210 MM, 130 G	24 H	MOR *	5,000		216115	75
	Salvelinus fontinalis; Brook trout;	14 MO, 210 MM, 130 G	24 H	MOR *	5,000		216115	75
	Salvelinus fontinalis; Brook trout;	14 MONTHS, 210 MM, 130 G	96 H	LC_{50} ?	3,600		216115	75
	Salvelinus fontinalis; Brook trout;	EYED EMBRYO - LARVAE	45 D	GRO *		283	312720	87
Aluminum sulfate (cont.)	Salvelinus fontinalis; Brook trout;	EYED EMBRYO - LARVAE	60 D	BEH *		283	312720	87
	Salvelinus fontinalis; Brook trout;	EYED EMBRYO - LARVAE	60 D	MOR *	283		312720	87
	Stizostedion lucioperca; Pikeperch;	11.5-16 MM	24 H	MOR *	400		212700	75
Arsenic	Ceriodaphnia reticulata; Water flea;	< 4 H	48 H	LC_{50}	1,800		311181	84
	Daphnia magna; Water flea;	< 24 H	48 H	LC_{50}	3,800		311181	84

Table O.1–9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
	Daphnia pulex; Water flea;	< 24 H	48 H	LC_{50}	1,900		311181	84
	Ictalurus punctatus; Channel catfish;	400 G	0.1 to 7 WK	RSD		1,910 to 2,500	315333	77
	Lepomis cyanellus; Green sunfish;	<4 YR, 5.5–90.7 G	4 MO	HIS		1,000 to 20,000	311560	85
	Lepomis macrochirus; Bluegill;	NR	6 MO	MOR *	5,000		212143	73
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	EC_{50}BM *		2,600	212262	74
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	EC_{50}BM *		2,900	212262	74
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	EC_{50}GR *		3,600	212262	74
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	EC_{50}GR *		4,100	212262	74
	Simocephalus vetulus; Water flea;	< 24 H	48 H	LC_{50}	$\boxed{1,700}$		311181	84
Barium	Daphnia magna; Water flea;	<= 24 H	24 H	LC_{50}	> 530,000		215184	80
	Daphnia magna; Water flea;	<= 24 H	48 H	LC_{50}	410,000		215184	80
	Daphnia magna; Water flea;	<= 24 H	48 H	MOR *	68,000		215184	80
	Lemna minor; Duckweed;	20 COLONIES OR 40 FRONDS	4 D	EC_{50}GR		26,000	311789	86
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	EC_{50}BM *		103,000	212262	74
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	EC_{50}BM *		41,200	212262	74
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	EC_{50}GR *		113,000	212262	74
	Myriophyllum spicatum; Water–milfoil;	4 CM APEX	32 D	EC_{50}GR *		83,800	212262	74
Barium chloride	Lemna minor; Duckweed	FRONDS	96 H	GRO		25000	283261	88
	Daphnia magna; Water flea	12 H	48 H	IMM		14500	228732	72
	Echinogammarus berilloni; Scud	NR	24 H	LC_{50}	336,000		307710	86
	Gammarus pulex; Scud	NR	24 H	LC_{50}	3,980,000		307706	86
	Salmo trutta; Brown trout	YEARLING	48 H	LC_{50}	150,000		240072	74
	Austropotamobius pallipes pall; Crayfish	19–32 MM	96 H	LC_{50}	46,000		228813	73
	Gambusia affinis; Mosquitofish	ADULT, FEMALE	24 H	LC_{50}	2,910,000		215454	57
	Orconectes limosus; Crayfish	19–32 MM	96 H	LC_{50}	78,000		228816	73
	Gambusia affinis; Mosquitofish	ADULT, FEMALE	96 H	MOR	66,200		215457	57
	Daphnia magna; Water flea	12 H	21 D	REP		$\boxed{8,900}$	228734	72
Cadmium	Algae; Algae, phytoplankton, algal mat	NATURAL COMMUNITY	2 to 244 H	PGR		3.4 to 84.0	311823	85
	Algae; Algae, phytoplankton, algal mat	EXPO GRO PHASE	24 H	PSE		<=56200	213095	89
	Algae; Algae, phytoplankton, algal mat	PHYTOPLANKTON	14 D	BMS *		100	313109	88
	Algae; Algae, phytoplankton, algal mat	NATURAL COMMUNITY	382 H	PGR		2.9 to 4.2	311823	85
	Anabolia nervosa; Quiver fly	LARVAE	7 D	LET	9,000,000		210725	57
	Anacystis nidulans; Blue–green algae	NR	48 H	BCF		500	312317	86
	Anacystis nidulans; Blue–green algae	NR	36 H	BCF		1,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	48 H	BCF		1,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	36 H	BCF		10,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	24 H	BCF		10,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	48 H	BCF		10,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	48 H	BCF		100	312317	86
	Anacystis nidulans; Blue–green algae	NR	12 H	BCF		5,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	24 H	BCF		500	312317	86
	Anacystis nidulans; Blue–green algae	NR	24 H	BCF		5,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	36 H	BCF		100	312317	86
Cadmium (cont.)	Anacystis nidulans; Blue–green algae	NR	36 H	BCF		5,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	24 H	BCF		1,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	24 H	BCF		100	312317	86
	Anacystis nidulans; Blue–green algae	NR	12 H	BCF		500	312317	86
	Anacystis nidulans; Blue–green algae	NR	48 H	BCF		5,000	312317	86
	Anacystis nidulans; Blue–green algae	NR	12 H	BCF		1,000	3123[illegible]	86

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Remedial Investigation Report
Devens, Massachusetts

Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
	Anacystis nidulans; Blue-green algae	NR	36 H	BCF		500	312317	86
	Anacystis nidulans; Blue-green algae	NR	12 H	BCF		100	312317	86
	Anacystis nidulans; Blue-green algae	NR	12 H	BCF		10,000	312317	86
	Anodonta anatina; Fresh-water mussel	80-100 MM	15 WK	RSD		0.5 to 1.0	213792	91
	Anodonta cygnea; Swan mussel	NR	to 12 WK	PHY *		50	213466	90
	Anodonta cygnea; Swan mussel	10 (8.5-11.5) CM	to 12 WK	BIO *		50	213467	90
	Asellus aquaticus; Aquatic sowbug	8-10 MM	96 H	LC_{50}*	60		312041	85
	Asellus aquaticus; Aquatic sowbug	JUVENILE, 30 D, 1.35 MM	96 H	LC_{50}	80		311953	86
	Asellus aquaticus; Aquatic sowbug	EMBRYO, STAGE D	96 H	LC_{50}	240		311953	86
	Asellus aquaticus; Aquatic sowbug	8-10 MM	48 H	LC_{50}*	3,600		312041	85

Table O.1-9
AQUIRE Freshwater Toxicity Information (μg/L)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference	Year of
					Lethal	Sublethal	Number	Publication
Cadmium (cont.)	Asellus aquaticus; Aquatic sowbug	JUVENILE, 1.60 MM	96 H	LC_{50}	170		311953	86
	Asellus aquaticus; Aquatic sowbug	8-10 MM	48 H	LC_{50}*	4,000		312041	85
	Asellus aquaticus; Aquatic sowbug	JUVENILE, 1.60 MM	96 H	LC_{50}	150		311953	86
	Asellus aquaticus; Aquatic sowbug	ADULT, 9.87 MM	96 H	LC_{50}	600		311953	86
	Asellus aquaticus; Aquatic sowbug	ADULT, 9.87 MM	96 H	LC_{50}	1,000		311953	86
	Asellus aquaticus; Aquatic sowbug	8-10 MM	24 H	LC_{50}*	13,000		312041	85
	Asellus aquaticus; Aquatic sowbug	EMBRYO, STAGE C	96 H	LC_{50}	2,000		311953	86
	Asellus aquaticus; Aquatic sowbug	8-10 MM	24 H	LC_{50}*	11,000		312041	85
	Asellus aquaticus; Aquatic sowbug	EMBRYO, STAGE D	96 H	LC_{50}	300		311953	86
	Asellus aquaticus; Aquatic sowbug	JUVENILE, 5.92 MM	96 H	LC_{50}	540		311953	86
	Asellus aquaticus; Aquatic sowbug	8-10 MM	96 H	LC_{50}*	60		312041	85
	Asellus aquaticus; Aquatic sowbug	JUVENILE, 3.52 MM	96 H	LC_{50}	230		311953	86
	Asellus aquaticus; Aquatic sowbug	JUVENILE, 5.92 MM	96 H	LC_{50}	450		311953	86
	Asellus aquaticus; Aquatic sowbug	JUVENILE, 3.52 MM	96 H	LC_{50}	320		311953	86
	Asellus aquaticus; Aquatic sowbug	JUVENILE, 30 D, 1.35 MM	96 H	LC_{50}	53		311953	86
	Asellus aquaticus; Aquatic sowbug	EMBRYO, STAGE C	96 H	LC_{50}	1,750		311953	86
	Asellus aquaticus; Aquatic sowbug	JUVENILE, 2.30 MM	96 H	LC_{50}	175		311953	86
	Asellus aquaticus; Aquatic sowbug	JUVENILE, 2.30 MM	96 H	LC_{50}	170		311953	86
	Astacus astacus; European crayfish	8-10 CM	to 10 WK	HIS		2	210376	91
	Astacus astacus; European crayfish	8-10 CM	2 WK	ENZ *		2	210376	91
	Baetis rhodani; Mayfly	8-10 MM	48 H	LC_{50}*	4,000		312041	85
	Baetis rhodani; Mayfly	8-10 MM	24 H	LC_{50}*	95,000		312041	85
	Baetis rhodani; Mayfly	8-10 MM	48 H	LC_{50}*	2,200		312041	85
	Baetis rhodani; Mayfly	8-10 MM	96 H	LC_{50}*	50		312041	85
	Baetis rhodani; Mayfly	8-10 MM	96 H	LC_{50}*	70		312041	85
	Baetis rhodani; Mayfly	8-10 MM	24 H	LC_{50}*	90,000		312041	85
	Brachionus calyciflorus; Rotifer	NEONATE	24 H	LC_{50}	1,300		219385	91
	Carassius auratus; Goldfish	5.0-20.9 G	14 D	HEM *		445	310472	84
	Catostomus commersoni; White sucker	JUVENILE, 142 MM, 28.7 G	1 WK	RSD		660	312412	87
	Ceriodaphnia reticulata; Water flea	< 4 H	48 H	LC_{50}	66		311181	84
	Channa punctatus; Snake-head catfish	FINGERLING	48 H	LC_{50}	34,640		313173	88
	Channa punctatus; Snake-head catfish	FINGERLING	96 H	LC_{50}	18,500		313173	88
	Channa punctatus; Snake-head catfish	FINGERLING	13 D	GRO *		3,500	313173	88
	Chironomidae; Midge family	LARVAE	12 MO	POP		7.6	213176	88
	Chironomus plumosus; Midge	LARVA-STATE L3	96 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L2	96 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L2	72 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L4	72 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L2	48 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L3	72 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L2	24 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L3	24 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L1	24 H	LC_{50}	21,530		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L4	96 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L4	24 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L3	48 H	LC_{50}	32,000		215356	89
	Chironomus plumosus; Midge	LARVA-STATE L4	48 H	LC_{50}	32,000		215356	89
	Chironomus riparius; Midge	LARVA-STATE L1	24 H	LC_{50}	53,610		215356	89
	Chironomus riparius; Midge	LARVA-STATE L4	24 H	LC_{50}	10,000		215356	89
	Chironomus riparius; Midge	LARVA-STATE L2	48 H	LC_{50}	10,000		215356	89
	Chironomus riparius; Midge	4TH INSTAR LARVAE	>10 D	RSD		50 to 100	212729	89

Table O.1–9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Cadmium (cont.)	Chironomus riparius; Midge	LARVA–STATE L2	72 H	LC_{50}	7,690		215356	89
	Chironomus riparius; Midge	EGGS	7 to 96 H	MOR *	1,000		215356	89
	Chironomus riparius; Midge	LARVA–STATE L3	24 H	LC_{50}	32,000		215356	89
	Chironomus riparius; Midge	LARVA–STATE L3	96 H	LC_{50}	7,360		215356	89
	Chironomus riparius; Midge	EGGS	7 to 96 H	MOR *	1,000		215356	89
	Chironomus riparius; Midge	LARVA–STATE L3	72 H	LC_{50}	15,210		215356	89
	Chironomus riparius; Midge	10–12 MM	48 H	LC_{50}*	200,000		312041	85
	Chironomus riparius; Midge	10–12 MM	96 H	LC_{50}*	300,000		312041	85
	Chironomus riparius; Midge	LARVA–STATE L4	96 H	LC_{50}	6,680		215356	89
	Chironomus riparius; Midge	LARVA–STATE L2	24 H	LC_{50}	10,000		215356	89
	Chironomus riparius; Midge	LARVA–STATE L4	48 H	LC_{50}	10,000		215356	89
	Chironomus riparius; Midge	EGGS	<=24 H	MOR *	3,200		215356	89
	Chironomus riparius; Midge	10–12 MM	24 H	LC_{50}*	200,000		312041	85
	Chironomus riparius; Midge	LARVA–STATE L3	48 H	LC_{50}	32,000		215356	89
	Chironomus riparius; Midge	LARVA–STATE L4	72 H	LC_{50}	10,000		215356	89
	Chironomus riparius; Midge	10–12 MM	96 H	LC_{50}*	200,000		312041	85
	Chironomus riparius; Midge	EGGS	<=24 H	MOR *	10,000		215356	89
	Chironomus riparius; Midge	LARVA–STATE L2	96 H	LC_{50}	4,320		215356	89
	Chironomus tentans; Midge	LARVA–STATE L1	24 H	LC_{50}	9,990		215356	89
	Chironomus tentans; Midge	LARVA–STATE L3	72 H	LC_{50}	730		215356	89
	Chironomus tentans; Midge	LARVA–STATE L3	48 H	LC_{50}	2,370		215356	89
	Chironomus tentans; Midge	LARVA–STATE L4	96 H	LC_{50}	1,410		215356	89
	Chironomus tentans; Midge	LARVA–STATE L3	24 H	LC_{50}	10,000		215356	89
	Chironomus tentans; Midge	LARVA–STATE L4	48 H	LC_{50}	2,700		215356	89
	Chironomus tentans; Midge	LARVA–STATE L2	96 H	LC_{50}	80		215356	89
	Chironomus tentans; Midge	LARVA–STATE L3	96 H	LC_{50}	480		215356	89
	Chironomus tentans; Midge	LARVA–STATE L2	72 H	LC_{50}	130		215356	89
	Chironomus tentans; Midge	LARVA–STATE L4	72 H	LC_{50}	1,930		215356	89
	Chironomus tentans; Midge	LARVA–STATE L2	24 H	LC_{50}	440		215356	89
	Chironomus tentans; Midge	LARVA–STATE L4	24 H	LC_{50}	10,000		215356	89
	Chironomus tentans; Midge	LARVA–STATE L2	48 H	LC_{50}	210		215356	89
	Chironomus thummi; Midge	LARVAE	7 D	LET	150,000		210725	57
	Chironomus yoshimatsui; Midge	3RD AND 4TH INSTAR	2 D	RSD *		10,000	311481	84
	Corbicula fluminea; Asiatic clam	ADULT 5 CM	1 D	RSD		0.3	312002	86
	Coregonus clupeaformis; Lake whitefish	26.63 G	72 D	BCF *		0.00125	210688	89
	Cyprinidae; Minnow, carp family	2 SUMMERS	84 H	LET *	25,000		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	5.63 D	LET *	20,000		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	7 D	MOR *	13,000		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	33 H	LET *	30,000		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	5.63 D	LET *	15,000		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	14 H	LET *	50,000		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	96 H	LET *	25,000		210725	57
	Cypris subglobosa; Ostracod	NR	96 H	LC_{50}	687.4		312365	88
	Cypris subglobosa; Ostracod	NR	24 H	LC_{50}	6,981		312365	88
	Cypris subglobosa; Ostracod	NR	48 H	LC_{50}	3,020		312365	88
	Cypris subglobosa; Ostracod	NR	12 H	LC_{50}	12,660		312365	88
	Daphnia lumholzi; Water flea	NR	96 H	LC_{50}	83		312365	88
	Daphnia lumholzi; Water flea	NR	48 H	LC_{50}	618.6		312365	88
	Daphnia lumholzi; Water flea	NR	12 H	LC_{50}	2,325		312365	88
	Daphnia lumholzi; Water flea	NR	24 H	LC_{50}	1,585		312365	88
	Daphnia magna; Water flea	<= 24 H	48 H	LC_{50}	33		310929	84

Table O.1−9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
Cadmium (cont.)	Daphnia magna; Water flea	< 24 H	21 D	REP *		3.2	310589	85
	Daphnia magna; Water flea	< 24 H	14 D	LC_{50}	24		310589	85
	Daphnia magna; Water flea	NR	3 WK	MOR *	7.78		210772	89
	Daphnia magna; Water flea	NR	3 WK	MOR *	22.9		210772	89
	Daphnia magna; Water flea	<= 24 H	48 H	LC_{50}	62		310929	84
	Daphnia magna; Water flea	< 24 H	21 D	LC_{50}	14		310589	85
	Daphnia magna; Water flea	< 24 H	48 H	LC_{50}	118		311181	84
	Daphnia magna; Water flea	< 24 H	21 D	LET	5.6		310589	85
	Daphnia magna; Water flea	< 24 H	21 D	MOR *	3.2		310589	85
	Daphnia magna; Water flea	NR	3 WK	REP *		1.86	210772	89
	Daphnia magna; Water flea	NR	28 D	MOR *	0.5		312770	87
	Daphnia magna; Water flea	<= 24 H	48 H	LC_{50}	40		310929	84
	Daphnia magna; Water flea	<= 24 H	48 H	LC_{50}	36		310929	84
	Daphnia magna; Water flea	<= 24 H	48 H	LC_{50}	24		310929	84
	Daphnia magna; Water flea	<= 24 H	48 H	LC_{50}	36		310929	84
	Daphnia magna; Water flea	< 24 H	21 D	MOR *	1.8		310589	85
	Daphnia magna; Water flea	NR	28 D	MOR *	1		312770	87
	Daphnia magna; Water flea	< 24 H	14 D	REP *		32	310589	85
	Daphnia magna; Water flea	< 24 H	21 D	MOR *	1		310589	85
	Daphnia magna; Water flea	< 24 H	21 D	GRO *		$\boxed{0.32}$	310589	85
	Daphnia magna; Water flea	NR	28 D	LET	5		312770	87
	Daphnia pulex; Water flea	< 24 H	48 H	LC_{50}	68		311181	84
	Dugesia tigrina; Turbellarian, flatworm	NR	96 H	LC_{50}	2,250		218709	74
	Elodea canadensis; Waterweed	SHOOTS	to 9 WK	RSD *		0.5 to 6.0	210652	77
	Ephemerella ignita; Mayfly	8−10 MM	24 H	LC_{50}*	54,000		312041	85
	Ephemerella ignita; Mayfly	8−10 MM	96 H	LC_{50}*	13,000		312041	85
	Ephemerella ignita; Mayfly	8−10 MM	24 H	LC_{50}*	61,000		312041	85
	Ephemerella ignita; Mayfly	8−10 MM	48 H	LC_{50}*	19,000		312041	85
	Ephemerella ignita; Mayfly	8−10 MM	96 H	LC_{50}*	12,000		312041	85
	Ephemerella ignita; Mayfly	8−10 MM	48 H	LC_{50}*	18,000		312041	85
	Esox lucius; Northern pike	50−160 G	to 11 WK	RSD		60 to 225	213460	90
	Gambusia affinis; Mosquitofish	NR	48 H	MOR *	6,700		313098	88
	Gammarus fasciatus; Scud	0−1 WK	6 WK	GRO *		3.42	210772	89
	Gammarus fasciatus; Scud	0−1 WK	6 WK	MOR *	2.23		210772	89
	Gammarus fasciatus; Scud	0−1 WK	6 WK	GRO *		2.23	210772	89
	Gammarus fasciatus; Scud	0−1 WK	6 WK	MOR *	1.49		210772	89
	Gammarus lacustris; Scud	NR	96 H	LC_{50}	40.1		313058	88
	Gammarus pulex; Scud	8−12 MM	24 H	LC_{50}*	1,300		312041	85
	Gammarus pulex; Scud	8−12 MM	96 H	LC_{50}*	20		312041	85
	Gammarus pulex; Scud	8−12 MM	96 H	LC_{50}*	30		312041	85
	Gammarus pulex; Scud	8−12 MM	24 H	LC_{50}*	1,600		312041	85
	Gammarus pulex; Scud	8−12 MM	48 H	LC_{50}*	400		312041	85
	Gammarus pulex; Scud	8−12 MM	48 H	LC_{50}*	400		312041	85
	Gammarus roeseli; Scud	NR	7 D	LET	400		210725	57
	Gasterosteus aculeatus; Three spine stickleback	0.3−0.6 G	to 10 D	RSD		2,500	312680	87
	Gastropoda; Snails, limpets class	NR	210 D	RSD *		2	219245	73
	Heteropneustes fossilis; Indian catfish	70 G	1 to 60 D	ENZ *		260	310049	82
	Hexagenia rigida; Mayfly	YEARLING, NYMPHS, 24 MM	96 H	LC_{50}	6,200		212091	80
	Hyalella azteca; Scud	0−1 WK	6 WK	MOR *	0.57		210772	89
	Hyalella azteca; Scud	0−1 WK	6 WK	MOR *	0.92		210772	89
	Hyalella azteca; Scud	0−1 WK	6 WK	GRO *		2.23	210772	89

Table O.1-9
AQUIRE Freshwater Toxicity Information (μg/L)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Cadmium (cont.)	Hydrodictyon reticulatum; Green algae	NR	1 to 168 H	BMS		100 to 10000	213348	89
	Hydropsyche angustipennis; Caddisfly	10-15 MM	96 H	LC_{50}*	520,000		312041	85
	Hydropsyche angustipennis; Caddisfly	10-15 MM	24 H	LC_{50}*	200,000		312041	85
	Hydropsyche angustipennis; Caddisfly	10-15 MM	48 H	LC_{50}*	200,000		312041	85
	Hydropsyche angustipennis; Caddisfly	10-15 MM	96 H	LC_{50}*	200,000		312041	85
	Ictalurus nebulosus; Brown bullhead	NR	24 H	THL *		50	313113	87
	Invertebrates; Invertebrates	ZOOPLANKTON	14 D	BMS *		3	312800	87
	Invertebrates; Invertebrates	CLADOCERA, COPEPODA, ROTIFERA	2 WK	POP *		3	311256	83
	Invertebrates; Invertebrates	ZOOPLANKTON	14 D	BMS *		1	312800	87
	Lamellidens marginalis; Mussel	7 CM	4.2 to 11.3 H	PHY *		500 to 2,000	213311	89
	Lamellidens marginalis; Mussel	5.0-6.0 CM	1 to 30 D	GRO		500 to 2,000	213776	91
	Lamellidens marginalis; Mussel	5.0-6.0 CM	1 to 30 D	OC		500 to 2,000	213776	91
	Lamellidens marginalis; Mussel	5.0-6.0 CM	96 H	LC_{50}	10,000		213776	91
	Lamellidens marginalis; Mussel	NR	96 H	LC_{50}	10,000		213311	89
	Lampsilis ventricosa; Lamp-mussel	NR	2 WK	RSD		< 2 to 4.5	312614	87
	Lemna minor; Duckweed	20 COLONIES OR 40 FRONDS	4 D	EC_{50}GR		200	311789	86
	Lepomis macrochirus; Bluegill	NR	48 H	ENZ *		1	213021	88
	Lepomis macrochirus; Bluegill	NR	14 D	PHY		1 to 100	212707	88
	Lepomis macrochirus; Bluegill	NR	6 MO	LET	5,000		212143	73
	Limnodrilus hoffmeisteri; Oligochaete	30-40 MM	24 H	LC_{50}*	24,000		312041	85
	Limnodrilus hoffmeisteri; Oligochaete	30-40 MM	96 H	LC_{50}*	2,900		312041	85
	Limnodrilus hoffmeisteri; Oligochaete	30-40 MM	24 H	LC_{50}*	20,000		312041	85
	Limnodrilus hoffmeisteri; Oligochaete	30-40 MM	48 H	LC_{50}*	6,400		312041	85
	Limnodrilus hoffmeisteri; Oligochaete	30-40 MM	48 H	LC_{50}*	6,800		312041	85
	Limnodrilus hoffmeisteri; Oligochaete	30-40 MM	96 H	LC_{50}*	2,400		312041	85
	Limnodrilus sp; Sludge worm	NR	14 D	RSD		50	311865	83
	Lophopodella carteri; Bryozoa	ANCENSTRULAE 2-3 DAYS	96 H	LC_{50}	150		216703	80
	Macrobrachium hendersodayanus; Prawn	NR	96 H	OC *		34	311545	84
	Morone saxatilis; Striped bass	LARVAE, 6 WK	290 H	LC_{50}	6		310625	85
	Morone saxatilis; Striped bass	LARVAE, 1 D	1 to 52 H	MOR	1 to 20		310625	85
	Morone saxatilis; Striped bass	LARVAE, 7 D	2 to 120 H	MOR	5 to 250		310625	85
	Myriophyllum spicatum; Water-milfoil	4 CM APEX	32 D	EC_{50}GR *		809,000	212262	74
	Myriophyllum spicatum; Water-milfoil	4 CM APEX	32 D	EC_{50}BM *		7,400	212262	74
	Myriophyllum spicatum; Water-milfoil	4 CM APEX	32 D	EC_{50}BM *		14,600	212262	74
	Myriophyllum spicatum; Water-milfoil	4 CM APEX	32 D	EC_{50}GR *		20,800	212262	74
	Noemacheilus barbatulus; Stone loach	5-12 G	to 15 WK	RSD		1,250	311872	86
	Noemacheilus barbatulus; Stone loach	5-15 G	2 to 77 D	RSD *		1,250	312707	87
	Noemacheilus barbatulus; Stone loach	2-21 G	to 119 D	RSD		3 to 1,250	213451	90
	Noemacheilus barbatulus; Stone loach	7-21 G	25 WK	BIO		3	219243	90
	Notemigonus crysoleucas; Golden shiner	NR	48 H	ENZ *		100	213021	88
	Notemigonus crysoleucas; Golden shiner	ADULT, 70-90 MM	12 H	ENZ *		1,350	312205	87
	Notemigonus crysoleucas; Golden shiner	ADULT, 70-90 MM	6 H	HEM *		1,350	312205	87
	Notemigonus crysoleucas; Golden shiner	NR	96 H	PHY		1,350 to 2,400	212707	88
	Notemigonus crysoleucas; Golden shiner	ADULT, 70-90 MM	96 H	LC_{50}	3,150		312205	87
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	30 H	LET *	7,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	150-220 G	to 1.5 H	RSD *		0.6 to 1.12	315315	81
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	JUVENILE, 10 G	1 WK	RSD *		3,000 to 60,000	312729	87
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	5.7 CM, 3.1 G	48 H	LC_{50}?	7		219245	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	FRY, 3 CM	48 H	LC_{50}	91		210459	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	NR	2 MO	MOR	18 to 54		312383	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	5.0 CM, 2.1 G	24 H	LC_{50}?	4,200		219245	73

Table O.1-9
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Cadmium (cont.)	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	7 D	MOR *	3,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	NR	3 MO	BIO		9	312383	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	5.0 CM, 2.1 G	96 H	LC_{50}?	6		219245	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	9-200 G	3 to 133 D	RSD		3 to 15	213451	90
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	375 G	3 D	PHY *		6.4	310404	84
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	77 H	LET *	5,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	FRY, 3 CM	48 H	LC_{50}	3,698		210459	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	FRY, 3 CM	48 H	LC_{50}	358		210459	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	NR	7 D	MOR *	8 to 10		310185	68
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	36-102 G	25 WK	BIO		3	219243	90
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	NR	280 D	RSD		0.01 to 4.8	219245	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	21 H	LET *	8,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	FRY, 3 CM	48 H	LC_{50}	677		210459	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	2 SUMMERS	5.92 D	LET *	8,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	NR	12 MO	BIO *		9	313110	88
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	5.7 CM, 1.1 G	96 H	LC_{50}?	7		219245	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	5.0 CM, 2.1 G	10 D	LC_{50}?	5		219245	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	5.7 CM, 1.1 G	10 D	LC_{50}?	7		219245	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	46.21 G	72 D	BCF *		0.00127	210688	89
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	6 D	LET *	4,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	375 G	178 D	PHY *		3.6	310404	84
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	5.0 CM, 2.1 G	48 H	LC_{50}?	9		219245	73
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	EYED EGGS	4 to 756 D	RSD		0.5 to 7.1	217341	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	18 H	LET *	10,000		210725	57
	Oryzias latipes; Medaka, high-eyes	FERTILIZED EGGS	1 WK	ABN *		10	310880	84
	Oryzias latipes; Medaka, high-eyes	EGG	NR	HAT		30 to 10,000	213213	89
	Oryzias latipes; Medaka, high-eyes	EGG	48 H	RSD		300 to 4,500	213212	89
	Pectinatella magnifica; Bryozoa	ANCENSTRULAE 2-3 DAYS	96 H	LC_{50}	700		216703	80
	Physa fontinalis; Bladder snail	10-12 MM	96 H	LC_{50}*	80		312041	85
	Physa fontinalis; Bladder snail	10-12 MM	48 H	LC_{50}*	2,100		312041	85
	Physa fontinalis; Bladder snail	10-12 MM	24 H	LC_{50}*	4,200		312041	85
	Physa fontinalis; Bladder snail	10-12 MM	48 H	LC_{50}*	1,800		312041	85
	Physa fontinalis; Bladder snail	10-12 MM	24 H	LC_{50}*	4,400		312041	85
	Physa fontinalis; Bladder snail	10-12 MM	96 H	LC_{50}*	80		312041	85
	Physa gyrina; Pouch snail	ADULT	48 H	LC_{50}?	4,250		212021	76
	Physa gyrina; Pouch snail	JUVENILE	48 H	LC_{50}?	690		212021	76
	Physa gyrina; Pouch snail	ADULT	228 H	LC_{50}?	830		212021	76
	Physa gyrina; Pouch snail	ADULT	4 to 60 H	REP		1,800 to 10,000	212021	76
	Physa gyrina; Pouch snail	ADULT	96 H	LC_{50}?	1,370		212021	76
	Physa gyrina; Pouch snail	JUVENILE	96 H	LC_{50}?	410		212021	76
	Physa gyrina; Pouch snail	ADULT	24 H	LC_{50}?	7,600		212021	76
	Pimephales promelas; Fathead minnow	NR	48 H	ENZ *		1	213021	88
	Pimephales promelas; Fathead minnow	NR	48 H	ENZ *		10	213021	88
	Plumatella emarginata; Bryozoan	ANCENSTRULAE 2-3 DAYS	96 H	LC_{50}	1,090		216703	80
	Polycelis tenuis; Turbellarian	10-12 MM	48 H	LC_{50}*	125,000		312041	85
	Polycelis tenuis; Turbellarian	10-12 MM	96 H	LC_{50}*	74,000		312041	85
	Polycelis tenuis; Turbellarian	10-12 MM	96 H	LC_{50}*	80,000		312041	85
	Polycelis tenuis; Turbellarian	10-12 MM	24 H	LC_{50}*	130,000		312041	85
	Polycelis tenuis; Turbellarian	10-12 MM	24 H	LC_{50}*	270,000		312041	85
	Polycelis tenuis; Turbellarian	10-12 MM	48 H	LC_{50}*	100,000		312041	85
	Potamogeton crispus; Curled pondweed	NR	NR	PSE *		1,000	21755[illegible]	77

Table O.1-9
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
Cadmium (cont.)	Procambarus clarkii; Red swamp crayfish	ADULT INTERMOLT	to 30 D	BIO		100	212572	89
	Procambarus clarkii; Red swamp crayfish	ADULT, INTERMOLT	96 H	ENZ *		100	312701	87
	Procambarus clarkii; Red swamp crayfish	ADULT INTERMOLT, 19.5-30.2 G	1 to 96 H	BIO *		10,000	215112	91
	Rutilus rutilus; Roach	100 G	to 25 WK	RSD		500	311872	86
	Rutilus rutilus; Roach	15-100 G	1 to 70 D	RSD *		30 to 500	312707	87
	Rutilus rutilus; Roach	NR	65 D	RSD		450	213451	90
	Salvelinus fontinalis; Brook trout	EMBRYO	NR	GRO *		0.02 to 2,000	218196	88
	Salvelinus fontinalis; Brook trout	1 SUMMER	47 H	LET *	10,000		210725	57
	Salvelinus fontinalis; Brook trout	1 SUMMER	26 H	LET *	25,000		210725	57
	Salvelinus fontinalis; Brook trout	1 SUMMER	7 D	MOR *	4,000		210725	57
	Salvelinus fontinalis; Brook trout	2 SUMMERS	5.83 D	LET *	25,000		210725	57
	Salvelinus fontinalis; Brook trout	1 SUMMER	76 H	LET *	6,000		210725	57
	Salvelinus fontinalis; Brook trout	1 SUMMER	4.42 D	LET *	5,000		210725	57
	Salvelinus fontinalis; Brook trout	1 SUMMER	55 H	LET *	8,000		210725	57
	Salvelinus fontinalis; Brook trout	EMBRYO	NR	HAT *		0.02 to 2,000	218196	88
	Salvelinus fontinalis; Brook trout	ADULT	30 D	STR *		3.6 to 60	312833	86
	Scyliorhinus canicula; Dogfish	NR	to 10 D	BIO		25,000 to 50,000	212560	89
	Selenastrum capricornutum; Green algae	25 E3 CELLS/ML, LAG PHASE	48 H	PGR *		30	213335	90
	Selenastrum capricornutum; Green algae	25 E3 CELLS/ML, LAG PHASE	48 H	PHY *		30	213335	90
	Simocephalus vetulus; Water flea	< 24 H	48 H	LC_{50}	24		311181	84
	Spirodela polyrhiza; Large duckweed	THREE FROND COLONY	14 D	PHY		100 to 10,000	213264	89
	Spirodela polyrhiza; Large duckweed	THREE FROND COLONY	14 D	PGR		100 to 10,000	213264	89
	Spirulina platensis; Blue-green algae	NR	12 H	BCF		5,000	312317	86
	Spirulina platensis; Blue-green algae	NR	36 H	BCF		10,000	312317	86
	Spirulina platensis; Blue-green algae	NR	24 H	BCF		10,000	312317	86
	Spirulina platensis; Blue-green algae	NR	48 H	BCF		1,000	312317	86
	Spirulina platensis; Blue-green algae	NR	12 H	BCF		1,000	312317	86
	Spirulina platensis; Blue-green algae	NR	36 H	BCF		1,000	312317	86
	Spirulina platensis; Blue-green algae	NR	48 H	BCF		5,000	312317	86
	Spirulina platensis; Blue-green algae	NR	36 H	BCF		100	312317	86
	Spirulina platensis; Blue-green algae	NR	48 H	BCF		500	312317	86
	Spirulina platensis; Blue-green algae	NR	48 H	BCF		10,000	312317	86
	Spirulina platensis; Blue-green algae	NR	12 H	BCF		10,000	312317	86
	Spirulina platensis; Blue-green algae	NR	48 H	BCF		100	312317	86
	Spirulina platensis; Blue-green algae	NR	36 H	BCF		5,000	312317	86
	Spirulina platensis; Blue-green algae	NR	12 H	BCF		500	312317	86
	Spirulina platensis; Blue-green algae	NR	24 H	BCF		500	312317	86
	Spirulina platensis; Blue-green algae	NR	24 H	BCF		1,000	312317	86
	Spirulina platensis; Blue-green algae	NR	24 H	BCF		5,000	312317	86
	Spirulina platensis; Blue-green algae	NR	24 H	BCF		100	312317	86
	Spirulina platensis; Blue-green algae	NR	12 H	BCF		100	312317	86
	Spirulina platensis; Blue-green algae	NR	36 H	BCF		500	312317	86
	Tilapia mossambica; Mozambique tilapia	103.59 G, 19.9 CM	to 45 D	HEM *		0.0783 to 6.4635	213331	90
	Tilapia mossambica; Mozambique tilapia	NR	to 6 WK	HEM *		100,000	312792	87
	Tinca tinca; Tench	1 SUMMER	21 H	LET *	50,000		210725	57
	Tinca tinca; Tench	1 SUMMER	73 H	LET *	25,000		210725	57
	Tinca tinca; Tench	1 SUMMER	5.08 D	LET *	20,000		210725	57
	Tinca tinca; Tench	2 SUMMERS	53 H	LET *	40,000		210725	57
	Tinca tinca; Tench	1 SUMMER	28 H	LET *	40,000		210725	57
	Tinca tinca; Tench	1 SUMMER	7 D	MOR *	19,000		210725	57
	Tribolodon hakonensis; Japanese barbel	4.3 CM, 1.1 G	48 H	LC_{50}?	56 to 100		219245	73

Table O.1−9
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Cadmium (cont.)	Tribolodon hakonensis; Japanese barbel	4.3 CM, 1.1 G	96 H	LC_{50}?	56 to 100		219245	73
	Tubifex sp; Tubificid worm	NR	14 D	RSD		50	311865	83
	Tubifex tubifex; Tubificid worm	NR	7 D	LET	5,000		210725	57
Chromium	Aedes aegypti; Mosquito;	LARVAE	48 H	LC_{50}	12,500		313255	88
	Ceriodaphnia reticulata; Water flea;	< 4 H	48 H	LC_{50}	45		311181	84
	Colisa fasciata; Giant gourami;	5.23 G, 5.41 CM, ADULT	24 H	HEM *		48,000	312803	87
	Colisa fasciata; Giant gourami;	NR	2 to 96 H	BIO *		48,000	312719	87
	Cyclops sp; Cyclopoid copepod;	ADULT	48 H	LC_{50}	10,470		313255	88
	Daphnia ambigua; Water flea;	12 H	72 H	$EC_{50}IM$		1,700	218476	76
	Daphnia ambigua; Water flea;	12 H	72 H	$EC_{50}IM$		7,700	218476	76
	Daphnia galeata; Water flea;	12 H	72 H	$EC_{50}IM$		65,600	218476	76
	Daphnia magna; Water flea;	12 H	72 H	$EC_{50}IM$		42,100	218476	76
	Daphnia magna; Water flea;	12 H	72 H	$EC_{50}IM$		5,200	218476	76
	Daphnia magna; Water flea;	24−48 HR, NEONATE	21 D	GRO *		5	213950	91
	Daphnia magna; Water flea;	< 24 H	48 H	LC_{50}	22		311181	84
	Daphnia magna; Water flea;	24−48 HR, NEONATE	21 D	MOR	5 to 15		213950	91
	Daphnia magna; Water flea;	24−48 HR, NEONATE	21 D	REP *		5	213950	91
	Daphnia pulex; Water flea;	< 24 H	48 H	LC_{50}	48		311181	84
	Daphnia pulex; Water flea;	NR	96 H	LC_{50}	90,400		210394	89
	Daphnia pulicaria; Water flea;	12 H	72 H	$EC_{50}IM$		110,800	218476	76
	Dugesia dorotocephala; Turbellarian, flatworm;	18−20 MM	1 H	BEH *		50 to 500	310581	91
	Dugesia tigrina; Turbellarian, flatworm;	NR	96 H	LC_{50}	2,220		218709	74
	Hydrodictyon reticulatum; Green algae;	NR	1 to 168 H	BMS		100 to 10000	213348	89
	Lemna minor; Duckweed;	20 COLONIES OR 40 FRONDS	4 D	$EC_{50}GR$		35,000	311789	86
	Lophopodella carteri; Bryozoa;	ANCENSTRULAE, 2−3 D	96 H	LC_{50}	1,560		216703	80
	Myriophyllum spicatum; Water−milfoil;	4 CM APEX	32 D	$EC_{50}BM$ *		14,600	212262	74
	Myriophyllum spicatum; Water−milfoil;	4 CM APEX	32 D	$EC_{50}BM$ *		9,900	212262	74
	Myriophyllum spicatum; Water−milfoil;	4 CM APEX	32 D	$EC_{50}GR$ *		24,400	212262	74
	Myriophyllum spicatum; Water−milfoil;	4 CM APEX	32 D	$EC_{50}GR$ *		26,000	212262	74
	Mystus vittatus; Catfish;	80−100 MM, 6−10 G	96 H	LC_{50} ?	200,000		315793	82
	Pectinatella magnifica; Bryozoa;	ANCENSTRULAE, 2−3 D	96 H	LC_{50}	1,440		216703	80
	Pimephales promelas; Fathead minnow;	40−68 MM	48 H	LC_{50}	58,000		210837	75
	Pimephales promelas; Fathead minnow;	40−68 MM	48 H	LC_{50}	61,000		210837	75
	Pimephales promelas; Fathead minnow;	40−68 MM	96 H	LC_{50}	37,000		210837	75
	Pimephales promelas; Fathead minnow;	40−68 MM	96 H	LC_{50}	52,000		210837	75
	Plumatella emarginata; Bryozoan;	ANCENSTRULAE, 2−3 D	96 H	LC_{50}	650		216703	80
	Simocephalus vetulus; Water flea;	< 24 H	48 H	LC_{50}	50		311181	84
Copper	Algae; Algae, phytoplankton, algal mat;	EXPO GRO PHASE	24 H	PSE		<=1270	213095	89
	Algae; Algae, phytoplankton, algal mat;	PHYTOPLANKTON	124 H	PGR		10 to 400	311876	83
	Algae; Algae, phytoplankton, algal mat;	PHYTOPLANKTON	14 D	BMS *		100	313109	88
	Aquatic community; Aquatic community;	OLIGOTROPHIC STREAM	NR	POP *		2.5 to 15	218766	88
	Brachionus calyciflorus; Rotifer;	NEONATE	24 H	LC_{50}	26		219385	91
	Brachionus calyciflorus; Rotifer;	NEONATE	24 H	LC_{50}	31		219385	91
	Callitriche platycarpa; Macrophyte;	NR	28 D	LT50 (Calc)	6,000		218344	78
	Carassius auratus; Goldfish;	NR	to 4 WK	PHY		100 to 4000	213419	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	26		213110	89
	Ceriodaphnia dubia; Water flea;	ADULT	48 H	LC_{50}	110		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	27		213110	89
	Ceriodaphnia dubia; Water flea;	ADULT	48 H	LC_{50}	63		213110	89

Table O.1–9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Copper (cont.)	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	28		213110	89
	Ceriodaphnia dubia; Water flea;	ADULT	48 H	LC_{50}	71		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	30		213110	89
	Ceriodaphnia dubia; Water flea;	ADULT	48 H	LC_{50}	79		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	95		213110	89
	Ceriodaphnia dubia; Water flea;	< 4 H	48 H	LC_{50}	17		311181	84
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	31		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	17		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	32		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	20		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	34		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	23		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	37		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	25		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	38		213110	89
	Ceriodaphnia dubia; Water flea;	ADULT	48 H	LC_{50}	66		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	42		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	104		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	49		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	21		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	58		213110	89
	Ceriodaphnia dubia; Water flea;	ADULT	48 H	LC_{50}	127		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	67		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	19		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	81		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	24		213110	89
	Ceriodaphnia dubia; Water flea;	NEONATE, <12 H, FIRST INSTAR	48 H	LC_{50}	78		213110	89
	Ceriodaphnia dubia; Water flea;	FIRST INSTAR NEONATES, 2–8 H	7 D	MOR	1.5 to 122.5		213110	89
	Ceriodaphnia dubia; Water flea;	FIRST INSTAR NEONATES, 2–8 H	7 D	REP *		$\boxed{1.5}$	213110	89
	Ceriodaphnia dubia; Water flea;	FIRST INSTAR NEONATES, 2–8 H	7 D	REP *		6.3	213110	89
	Chironomidae; Midge family;	LARVAE	12 MO	POP		67	213176	88
	Chironomus plumosus; Midge;	LARVA–STATE L1	24 H	LC_{50}	3,160		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L2	24 H	LC_{50}	8,590		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L2	48 H	LC_{50}	3,760		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L2	72 H	LC_{50}	1,990		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L2	96 H	LC_{50}	1,580		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L3	24 H	LC_{50}	>10000		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L3	48 H	LC_{50}	2,050		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L3	72 H	LC_{50}	980		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L3	96 H	LC_{50}	530		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L4	24 H	LC_{50}	23,600		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L4	48 H	LC_{50}	12,510		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L4	72 H	LC_{50}	6,260		215356	89
	Chironomus plumosus; Midge;	LARVA–STATE L4	96 H	LC_{50}	2,200		215356	89
	Chironomus riparius; Midge;	2ND INSTAR LARVAE	240 H	LC_{50}	200		215023	91
	Chironomus riparius; Midge;	2ND INSTAR LARVAE	48 H	LC_{50}	1,200		215023	91
	Chironomus riparius; Midge;	2ND INSTAR LARVAE	96 H	LC_{50}	700		215023	91
	Chironomus riparius; Midge;	LARVA–STATE L1	24 H	LC_{50}	3,400		215356	89
	Chironomus riparius; Midge;	LARVA–STATE L2	24 H	LC_{50}	9,070		215356	89
	Chironomus riparius; Midge;	LARVA–STATE L2	48 H	LC_{50}	3,910		215356	89
	Chironomus riparius; Midge;	LARVA–STATE L2	72 H	LC_{50}	1,860		215356	89

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Copper (cont.)	Chironomus riparius; Midge;	LARVA-STATE L2	96 H	LC_{50}	1,270		215356	89
	Chironomus riparius; Midge;	LARVA-STATE L3	24 H	LC_{50}	13,430		215356	89
	Chironomus riparius; Midge;	LARVA-STATE L3	48 H	LC_{50}	4,220		215356	89
	Chironomus riparius; Midge;	LARVA-STATE L3	72 H	LC_{50}	1,630		215356	89
	Chironomus riparius; Midge;	LARVA-STATE L3	96 H	LC_{50}	1,260		215356	89
	Chironomus riparius; Midge;	LARVA-STATE L4	24 H	LC_{50}	8,990		215356	89
	Chironomus riparius; Midge;	LARVA-STATE L4	48 H	LC_{50}	2,940		215356	89
	Chironomus riparius; Midge;	LARVA-STATE L4	72 H	LC_{50}	1,120		215356	89
	Chironomus riparius; Midge;	LARVA-STATE L4	96 H	LC_{50}	640		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L1	24 H	LC_{50}	2,700		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L2	24 H	LC_{50}	7,100		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L2	48 H	LC_{50}	2,400		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L2	72 H	LC_{50}	1,350		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L2	96 H	LC_{50}	540		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L3	24 H	LC_{50}	10,100		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L3	48 H	LC_{50}	3,100		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L3	72 H	LC_{50}	850		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L3	96 H	LC_{50}	550		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L4	24 H	LC_{50}	>10000		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L4	48 H	LC_{50}	2,200		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L4	72 H	LC_{50}	870		215356	89
	Chironomus tentans; Midge;	LARVA-STATE L4	96 H	LC_{50}	310		215356	89
	Chlorella vulgaris; Green algae;	NR	8 D	PGR		10 to 400	311876	83
	Cypris subglobosa; Ostracod;	NR	12 H	LC_{50}	13,581		312365	88
	Cypris subglobosa; Ostracod;	NR	24 H	LC_{50}	12,200		312365	88
	Cypris subglobosa; Ostracod;	NR	48 H	LC_{50}	5,363		312365	88
	Cypris subglobosa; Ostracod;	NR	96 H	LC_{50}	277.3		312365	88
	Daphnia lumholzi; Water flea;	NR	12 H	LC_{50}	83		312365	88
	Daphnia lumholzi; Water flea;	NR	24 H	LC_{50}	67.2		312365	88
	Daphnia lumholzi; Water flea;	NR	48 H	LC_{50}	54.6		312365	88
	Daphnia lumholzi; Water flea;	NR	96 H	LC_{50}	9.4		312365	88
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		266	310633	84
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		341	310633	84
	Daphnia magna; Water flea;	<= 24 H	48 H	EC_{50}IM (Calc)		31.8	310529	83
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		36	310633	84
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		146	310633	84
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		55	310633	84
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		257	310633	84
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		92.8	310633	84
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		102	310633	84
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		96.6	310633	84
	Daphnia magna; Water flea;	> 24 H	48 H	EC_{50}IM (Calc)		207	310633	84
	Daphnia magna; Water flea;	< 24 H	48 H	LC_{50}	54		311181	84
	Daphnia magna; Water flea;	NR	24 H	MOR	772		312372	85
	Daphnia pulex; Water flea;	< 24 H	36 D	LET	10.1		310453	84
	Daphnia pulex; Water flea;	< 24 H	42 D	REP *		10.1	310453	84
	Daphnia pulex; Water flea;	< 24 H	48 H	LC_{50}	53		311181	84
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	10.8		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	11.4		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	113		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	165		21508[illegible]	78

Table O.1−9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Copper (cont.)	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	184		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	199		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	213		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	240		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	35.5		215081	78

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Remedial Investigation Report
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration: Lethal	Effect Concentration: Sublethal	AQUIRE Reference Number	Year of Publication
Copper (cont.)	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	53.3		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	55.3		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	55.4		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	627		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	7.24		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	76.4		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	78.8		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	84.7		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	9.06		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	9.3		215081	78
	Daphnia pulicaria; Water flea;	NR	48 H	LC_{50}	97.2		215081	78
	Dugesia dorotocephala; Turbellarian, flatworm;	18-20 MM	1 H	BEH *		20 to 200	310581	91
	Dugesia tigrina; Turbellarian, flatworm;	NR	96 H	LC_{50}	2,450		218709	74
	Elodea nuttallii; Waterweed, ditchmoss;	NR	14 D	LT50 (Calc)	6,000		218344	78
	Gambusia affinis; Mosquitofish;	NR	12 H	LC_{50} ?	49		315578	78
	Gambusia affinis; Mosquitofish;	NR	133 D	MOR *	3.2		315578	78
	Gambusia affinis; Mosquitofish;	NR	48 H	MOR *	160		313098	88
	Gambusia affinis; Mosquitofish;	NR	96 H	LC_{50} ?	56		315578	78
	Gammarus lacustris; Scud;	ADULT	0.12 H	BEH		0.05 to 5000	311804	83
	Gammarus lacustris; Scud;	NR	96 H	LC_{50}	212		313058	88
	Gammarus pulex; Scud;	JUVENILE, 2-3 MOLT, 3-5 MM	240 H	LC_{50}	33		215023	91
	Gammarus pulex; Scud;	JUVENILE, 2-3 MOLT, 3-5 MM	48 H	LC_{50}	47		215023	91
	Gammarus pulex; Scud;	JUVENILE, 2-3 MOLT, 3-5 MM	96 H	LC_{50}	37		215023	91
	Gnathonemus petersii; Electric fish;	JUVENILE, 5-20 G	4 H	PHY *		500	310685	84
	Invertebrates; Invertebrates;	MACRO-INVERTEBRATES	14 D	BEH *		5.5	213398	89
	Invertebrates; Invertebrates;	MACROINVERTEBRATES	10 D	LC_{50}	15		210388	89
	Invertebrates; Invertebrates;	MACROINVERTEBRATES	10 D	LC_{50}	6		210388	89
	Invertebrates; Invertebrates;	MACROINVERTEBRATES	4 D	LC_{50}	14		210388	89
	Invertebrates; Invertebrates;	MACROINVERTEBRATES	4 D	LC_{50}	26		210388	89
	Lamellidens marginalis; Mussel;	5.0-6.0 CM	1 to 30 D	GRO		250 to 1000	213776	91
	Lamellidens marginalis; Mussel;	5.0-6.0 CM	1 to 30 D	OC		250 to 1000	213776	91
	Lamellidens marginalis; Mussel;	5.0-6.0 CM	96 H	LC_{50}	5,000		213776	91
	Lamellidens marginalis; Mussel;	7 CM	to 9.75 H	PHY *		250 to 1000	213311	89
	Lamellidens marginalis; Mussel;	NR	96 H	LC_{50}	5,000		213311	89
	Lamellidens marginalis; Mussel;	NR	96 H	LC_{50}	5,000		213875	91
	Lemna minor; Duckweed;	20 COLONIES OR 40 FRONDS	4 D	EC_{50}GR		1,100	311789	86
	Lemna minor; Duckweed;	NR	21 D	LT50 (Calc)	6,000		218344	78
	Lepomis macrochirus; Bluegill;	5.3-7.2 CM, 3.5-3.9 G	96 H	LC_{50}	1,250		212406	68
	Lepomis macrochirus; Bluegill;	NR	4 D	BEH		36 to 130	212858	89
	Lepomis macrochirus; Bluegill;	NR	NR	BEH		25 to 1800	212858	89
	Lophopodella carteri; Bryozoa;	ANCENSTRULAE, 2-3 DAYS	96 H	LC_{50}	510		216703	80
	Macrobrachium hendersodayanus; Prawn;	NR	96 H	OC *		1,750	311545	84
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}BM *		250	212262	74
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}BM *		380	212262	74
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}GR *		1,500	212262	74
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}GR *		700	212262	74
	Oncorhynchus kisutch; Coho salmon, silver salmon;	JUVENILE, 6 G	96 H	LC_{50}	164 ; 17		310541	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	11 CM, 13 G	96 H	LC_{50} ?	250		212122	72
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	32 MM, 0.36 G	15 H *	MOR *	200		218499	74
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	32 MM, 0.36 G	16.67 H *	MOR *	200		218499	74
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	32 MM, 0.36 G	24 H	LC_{50}	130		218499	74

Table O.1–9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
Copper (cont.)	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	32 MM, 0.36 G	24 H	LC_{50}	140		218499	74
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	32 MM, 0.36 G	4.33 H *	MOR *	2,000		218499	74
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	32 MM, 0.36 G	5.5 H *	MOR *	2,000		218499	74
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	55.5 G	40 D	GRO *		225	218386	76
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	6–8 G	48 H	HEM *		30	219917	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	75–100 G	48 H	MOR *	85		315401	82
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	75–100 G	8 H	PHY *		170	315401	82
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 0.2 G	1 WK	MOR *	4.0		315625	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 0.2 G	1 WK	MOR *	5.8		315625	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 0.2 G	1 WK	MOR *	9.6		315625	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 0.2 G	7 D	PHY *		4.0	315625	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 0.25 G	1 WK	MOR *	5.1		315625	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 0.25 G	1 WK	MOR *	9.5		315625	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 0.25 G	7 D	PHY *		2.1	315625	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 0.25 G	7 D	PHY *		3.9	315625	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING, 0.6 G	7 D	PHY *		6	315625	79
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NR	13 MO	MOR *	10		212122	72
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NR	13 MO	MOR *	19		212122	72
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NR	48 H	LC_{50}	400		218317	68
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NR	48 H	LC_{50}	500		218317	68
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	SAC–FRY	42 D	GRO * (Calc)		3	310527	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	SAC–FRY	42 D	MOR *	17		310527	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	SAC–FRY	42 D	MOR *	31		310527	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	SAC–FRY	42 D	MOR * (Calc)	10		310527	83
	Osteichthyes; Bony fish class;	ADULT GUPPY, 20–30 MM	48 H	LC_{50}	21		212882	88
	Osteichthyes; Bony fish class;	ADULT GUPPY, 20–30 MM	96 H	LC_{50}	16		212882	88
	Osteichthyes; Bony fish class;	JUVENILE GUPPY, 8–15 MM	48 H	LC_{50}	14		212882	88
	Osteichthyes; Bony fish class;	JUVENILE GUPPY, 8–15 MM	96 H	LC_{50}	8.7		212882	88
	Pectinatella magnifica; Bryozoa;	ANCENSTRULAE, 2–3 DAYS	96 H	LC_{50}	140		216703	80
	Pimephales promelas; Fathead minnow;	EMBRYO, 1 D	30 D	GRO *		221.8	215081	78
	Pimephales promelas; Fathead minnow;	NEWLY HAT, < 24 H	7 D	GRO *		9.89	311182	85
	Pimephales promelas; Fathead minnow;	NEWLY HAT, < 24 H	7 D	GRO *		25.8	311182	85
	Pimephales promelas; Fathead minnow;	NEWLY HAT, < 24 H	7 D	LC_{50}	70		311182	85
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	1,129		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	114		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	2,336		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	121		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	1,001		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	550		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	2,050		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	436		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	516		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	88.5		215081	78
	Pimephales promelas; Fathead minnow;	NR	96 H	LC_{50}	1,586		215081	78
	Pimephales promelas; Fathead minnow;	20–69 MM	96 H	LC_{50} ?	5,600		218320	76
	Pimephales promelas; Fathead minnow;	20–69 MM	96 H	LC_{50} ?	20,000		218320	76
	Pimephales promelas; Fathead minnow;	20–69 MM	96 H	LC_{50} ?	21,000		218320	76
	Pimephales promelas; Fathead minnow;	20–69 MM	96 H	LC_{50} ?	21,000		218320	76
	Pimephales promelas; Fathead minnow;	20–69 MM	96 H	LC_{50} ?	> 16,000		218320	76
	Pimephales promelas; Fathead minnow;	20–69 MM	96 H	LC_{50} ?	20,000		218320	76
	Pimephales promelas; Fathead minnow;	20–69 MM	96 H	LC_{50} ?	21,000		218320	76

Table O.1-9
AQUIRE Freshwater Toxicity Information (μg/L)
AOC 57

Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
Copper (cont.)	Pimephales promelas; Fathead minnow;	EMBRYO, 1 D	30 D	MOR *	221.8		215081	78
	Plumatella emarginata; Bryozoan;	ANCENSTRULAE, 2-3 DAYS	96 H	LC_{50}	140		216703	80
	Poecilia reticulata; Guppy;	JUVENILE	96 H	LC_{50}	112		212010	76
	Poecilia reticulata; Guppy;	JUVENILE	96 H	LC_{50}	138		212010	76
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	1045 H	LC_{50}	890		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	1227 H	LC_{50}	776		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	1358 H	LC_{50}	657		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	146 H	LC_{50}	3,024		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	246 H	LC_{50}	2,330		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	342 H	LC_{50}	1,780		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	453 H	LC_{50}	1,520		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	49 H	LC_{50}	11,000		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	549 H	LC_{50}	1,380		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	622 H	LC_{50}	1,190		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	72 H	LC_{50}	8,100		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	734 H	LC_{50}	1,150		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	843 H	LC_{50}	1,090		311758	83
	Procambarus clarkii; Red swamp crayfish;	ADULT, 24.8 G, 9.3 CM	945 H	LC_{50}	1,000		311758	83
	Procambarus clarkii; Red swamp crayfish;	EMBRYO	1147 H	LC_{50}	206		311758	83
	Procambarus clarkii; Red swamp crayfish;	EMBRYO	1267 H	LC_{50}	184		311758	83
	Procambarus clarkii; Red swamp crayfish;	EMBRYO	436 H	LC_{50}	3,350		311758	83
	Procambarus clarkii; Red swamp crayfish;	EMBRYO	598 H	LC_{50}	1,700		311758	83
	Procambarus clarkii; Red swamp crayfish;	EMBRYO	855 H	LC_{50}	1,140		311758	83
	Procambarus clarkii; Red swamp crayfish;	EMBRYO	903 H	LC_{50}	716		311758	83
	Procambarus clarkii; Red swamp crayfish;	EMBRYO	927 H	LC_{50}	556		311758	83
	Procambarus clarkii; Red swamp crayfish;	LARVAE	12 H	LC_{50}	4,170		311758	83
	Procambarus clarkii; Red swamp crayfish;	LARVAE	140 H	LC_{50}	527		311758	83
	Procambarus clarkii; Red swamp crayfish;	LARVAE	24 H	LC_{50}	1,990		311758	83
	Procambarus clarkii; Red swamp crayfish;	LARVAE	247 H	LC_{50}	242		311758	83
	Procambarus clarkii; Red swamp crayfish;	LARVAE	344 H	LC_{50}	199		311758	83
	Procambarus clarkii; Red swamp crayfish;	LARVAE	456 H	LC_{50}	146		311758	83
	Procambarus clarkii; Red swamp crayfish;	LARVAE	48 H	LC_{50}	1,350		311758	83
	Procambarus clarkii; Red swamp crayfish;	LARVAE	504 H	LC_{50}	67		311758	83
	Procambarus clarkii; Red swamp crayfish;	LARVAE	98 H	LC_{50}	720		311758	83
	Salmo salar; Atlantic salmon;	2-3 YR	96 H	LC_{50}	125		212068	72
	Salmo trutta; Brown trout;	78 G, 3RD YR CLASS	53 D	HIS *		15	310527	83
	Salvelinus fontinalis; Brook trout;	YEARLING, 14-16 CM, 30-42 G *	720 D	GRO *		9.4	218397	74
	Salvelinus fontinalis; Brook trout;	YEARLING, 14-16 CM, 30-42 G *	720 D	HAT *		9.4	218397	74
	Salvelinus fontinalis; Brook trout;	YEARLING, 14-16 CM, 30-42 G *	720 D	MOR *	9.4		218397	74
	Salvelinus fontinalis; Brook trout;	YEARLING, 14-16 CM, 30-42 G *	720 D	REP *		9.4	218397	74
	Simocephalus vetulus; Water flea;	< 24 H	48 H	LC_{50}	57		311181	84
Iron	Dugesia dorotocephala; Turbellarian, flatworm;	18-20 MM	1 H	BEH *		1,000 to 50,000	310581	91
	Lemna minor; Duckweed;	20 COLONIES OR 40 FRONDS	4 D	EC_{50}GR		$\boxed{3,700}$	311789	86
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	EGGS AND LARVA	NR	DVP *		5,700	315523	82
	Salmo trutta; Brown trout;	ALEVIN	NR	MOR *	5,170		311637	83
	Salmo trutta; Brown trout;	EGG	NR	HAT *		460	311637	83
	Salmo trutta; Brown trout;	EYED EGGS	NR	MOR *	5,170		311637	83
	Salmo trutta; Brown trout;	NEWLY HAT ALEVIN	NR	MOR *	3,020		311637	83
	Tilapia sparrmanii; Banded bream;	10.24-99.43 G	2 to 72 H	OC *		88,000	213066	89

Table O.1-9
AQUIRE Freshwater Toxicity Information (μg/L)
AOC 57

Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
Lead	Astacus astacus; European crayfish;	8-10 CM	2 WK	ENZ *		20	210376	91
	Astacus astacus; European crayfish;	8-10 CM	to 10 WK	HIS		20	210376	91
	Barbus arulius; Barb;	1.24 G	4 D	HIS		200,000 to 400,0(	219972	87
	Brachionus calyciflorus; Rotifer;	NEONATE	24 H	LC_{50}	> 4,000		219385	91
	Brachydanio rerio; Zebra danio, zebrafish;	DECHLORIONATED EGG	24 H			72	219870	80
	Brachydanio rerio; Zebra danio, zebrafish;	EGG	48 H			72	219870	80
	Bufo arenarum; Toad;	EMBRYO	24 H	DVP *		1,000	213162	90
	Bufo arenarum; Toad;	EMBRYO	24 H	MOR *	1,000		213162	90
	Carassius auratus; Goldfish;	UNDERYEARLING	1 WK *	ENZ *		470	315460	77
	Ceriodaphnia reticulata; Water flea;	< 4 H	48 H	LC_{50}	$\boxed{530}$		311181	84
	Daphnia magna; Water flea;	< 24 H	48 H	LC_{50}	4,400		311181	84
	Daphnia pulex; Water flea;	< 24 H	48 H	LC_{50}	5,100		311181	84
	Dugesia dorotocephala; Turbellarian, flatworm;	18-20 MM	1 H	BEH *		100 to 1,000	310581	91
	Dugesia tigrina; Turbellarian, flatworm;	NR	96 H	LC_{50}	160,000		218709	74
	Hyalella azteca; Scud;	NR	5 D	LC_{100}	5,000		219804	80
	Lemna minor; Duckweed;	20 COLONIES OR 40 FRONDS	4 D	EC_{50}GR		8,000	311789	86
	Lepomis gibbosus; Pumpkinseed;	> 1.75 YR	<=2 WK *	ENZ *		90	315460	77
	Micropterus dolomieui; Smallmouth bass;	EGG	96 H	MOR *	<=15,900		312153	86
	Micropterus dolomieui; Smallmouth bass;	FINGERLING	10 WK	LOC *		405	312153	86
	Micropterus dolomieui; Smallmouth bass;	FINGERLING	90 D	GRO *		405	312153	86
	Micropterus dolomieui; Smallmouth bass;	FINGERLING	90 D	HEM *		405	312153	86
	Micropterus dolomieui; Smallmouth bass;	FINGERLING	96 H	LC_{50}	29,000		312153	86
	Micropterus dolomieui; Smallmouth bass;	SAC FRY, 7 D POST-SPAWN	96 H	MOR *	<=15,900		312153	86
	Micropterus dolomieui; Smallmouth bass;	SWIM-UP FRY, 17 D POST-SPAWN	96 H	LC_{50}	2,800		312153	86
	Micropterus dolomieui; Smallmouth bass;	SWIM-UP, FRY 17 D POST-SPAWN	96 H	LC_{50}	2,200		312153	86
	Micropterus salmoides; Largemouth bass;	NR	24 H	BEH *		1,500	311127	78
	Micropterus salmoides; Largemouth bass;	NR	24 H	RES *		1,050	311127	78
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}BM *		363,000	212262	74
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}BM *		808,000	212262	74
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}GR *		725,000	212262	74
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}GR *		767,000	212262	74
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	10.5 G	32 WK	HIS *			310573	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	15 G	24 H	HEM *		130	315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	110		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	120		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	120		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	210		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	300		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	470		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	490		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	500		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	52		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	53		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	740		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	80		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	85		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	900		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	4 MO, 15 G	4 to 72 H	MOR *	910		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	53 G	1 WK	MOR *	1,000		315719	78
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	6-18 MO	<=2 WK *	ENZ *		10	315460	77
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	6.5 G	30 WK	HIS *		120	310573	83

Table O.1-9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Lead (cont.)	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NEWLY HAT, SAC FRY	189 D	ABN *		32	219830	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NEWLY HAT, SAC FRY	189 D	ENZ *		100	219830	80
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NEWLY HAT, SAC FRY	189 D	HEM *		100	219830	80
	Pimephales promelas; Fathead minnow;	JUVENILE	4 WK	PHY		500 to 1,000	210204	89
	Potamogeton crispus; Curled pondweed;	NR	NR	PSE *		25,000	217552	77
	Salvelinus fontinalis; Brook trout;	6-18 MO	<=2 WK *	ENZ *		90	315460	77
	Simocephalus vetulus; Water flea;	< 24 H	48 H	LC_{50}	4,500		311181	84
Manganese	Algae; Algae, phytoplankton, algal mat;	NATURAL COLONY	38 D	POP *		$\boxed{280}$	212862	69
	Anabolia nervosa; Quiver fly;	LARVAE	7 D	LET	2,000,000		210725	57
	Chironomus thummi; Midge;	LARVAE	7 D	LET	1,000,000		210725	57
	Cyprinidae; Minnow, carp family;	1 SUMMER	2.25 H	LET *	1,000,000		210725	57
	Cyprinidae; Minnow, carp family;	1 SUMMER	24 H	LET *	2,000,000		210725	57
	Cyprinidae; Minnow, carp family;	1 SUMMER	25 H	LET *	1,800,000		210725	57
	Cyprinidae; Minnow, carp family;	1 SUMMER	4.17 D	LET *	800,000		210725	57
	Cyprinidae; Minnow, carp family;	1 SUMMER	5.13 D	LET *	700,000		210725	57
	Cyprinidae; Minnow, carp family;	1 SUMMER	6.63 D	LET *	650,000		210725	57
	Cyprinidae; Minnow, carp family;	1 SUMMER	7 D	MOR *	600,000		210725	57
	Cyprinidae; Minnow, carp family;	1 SUMMER	78 H	LET *	900,000		210725	57
	Cyprinidae; Minnow, carp family;	2 SUMMERS	48 H	LET *	2,000,000		210725	57
	Gammarus roeseli; Scud;	NR	7 D	LET	70,000		210725	57
	Lemna minor; Duckweed;	20 COLONIES OR 40 FRONDS	4 D	EC_{50}GR		31,000	311789	86
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	1 SUMMER	10 H	LET *	700,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	1 SUMMER	13 H	LET *	600,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	1 SUMMER	34 H	LET *	300,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	1 SUMMER	5 D	LET *	100,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	1 SUMMER	7 D	MOR *	75,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	1 SUMMER	77 H	LET *	150,000		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	2 SUMMERS	34 H	LET *	600,000		210725	57
	Salvelinus fontinalis; Brook trout;	1 SUMMER	15 H	LET *	700,000		210725	57
	Salvelinus fontinalis; Brook trout;	1 SUMMER	23 H	LET *	600,000		210725	57
	Salvelinus fontinalis; Brook trout;	1 SUMMER	4.79 D	LET *	150,000		210725	57
	Salvelinus fontinalis; Brook trout;	1 SUMMER	66 H	LET *	300,000		210725	57
	Salvelinus fontinalis; Brook trout;	1 SUMMER	7 D	MOR *	100,000		210725	57
	Salvelinus fontinalis; Brook trout;	2 SUMMERS	41 H	LET *	600,000		210725	57
	Tinca tinca; Tench;	1 SUMMER	48 H	LET *	2,000,000		210725	57
	Tinca tinca; Tench;	1 SUMMER	6.75 D	LET *	1,500,000		210725	57
	Tinca tinca; Tench;	1 SUMMER	7 D	MOR *	1,200,000		210725	57
	Tinca tinca; Tench;	1 SUMMER	7 D	MOR *	1,300,000		210725	57
	Tinca tinca; Tench;	1 SUMMER	96 H	LET *	1,800,000		210725	57
	Tinca tinca; Tench;	2 SUMMERS	7 D	LET *	2,000,000		210725	57
	Tubifex tubifex; Tubificid worm;	NR	7 D	LET	700,000		210725	57
Mercury	Aedes aegypti; Mosquito	LARVAE	48 H	LC_{50}	290		313255	88
	Algae; Algae, phytoplankton, algal mat	PHYTOPLANKTON	14 D	BMS *		100	313109	88
	Amoeba sp; Amoeba	NR	>1.66 H	LT_{50}	$\boxed{500}$		218981	73
	Anabolia nervosa; Quiver fly	LARVAE	7 D	LET	2,000		210725	57
	Brachionus calyciflorus; Rotifer	NEONATE	24 H	LC_{50}	60		219385	91
	Carassius auratus; Goldfish	20-25G	to 15 D	BIO *		50	219207	72
	Carassius auratus; Goldfish	NR	8 D	RSD *		230	219568	71
	Carassius auratus; Goldfish	15-25G	to 15 D	BIO *		50	219207	72

Table O.1–9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
Mercury (cont.)	Caridina rajadhari; Freshwater prawn	NR	48 H	LC_{50}	6.918		311025	85
	Caridina rajadhari; Freshwater prawn	NR	72 H	LC_{50}	5.784		311025	85
	Caridina rajadhari; Freshwater prawn	NR	24 H	LC_{50}	9.12		311025	85
	Caridina rajadhari; Freshwater prawn	STAGE C, 2.5 CM	30 D	HIS * (Calc)		0.51	311025	85
	Caridina rajadhari; Freshwater prawn	NR	96 H	LC_{50}	4.786		311025	85
	Catostomus commersoni; White sucker	JUVENILE, 142 MM, 28.7 G	1 WK	RSD		190	312412	87
	Chironomus plumosus; Midge	LARVA–STATE L3	24 H	LC_{50}	2,430		215356	89
	Chironomus plumosus; Midge	LARVA–STATE L3	72 H	LC_{50}	1,360		215356	89
	Chironomus plumosus; Midge	LARVA–STATE L3	48 H	LC_{50}	1,760		215356	89
	Chironomus plumosus; Midge	LARVA–STATE L4	48 H	LC_{50}	1,280		215356	89
	Chironomus plumosus; Midge	LARVA–STATE L4	96 H	LC_{50}	880		215356	89
	Chironomus plumosus; Midge	LARVA–STATE L3	96 H	LC_{50}	600		215356	89
	Chironomus plumosus; Midge	LARVA–STATE L4	24 H	LC_{50}	3,230		215356	89
	Chironomus plumosus; Midge	LARVA–STATE L4	72 H	LC_{50}	880		215356	89
	Chironomus plumosus; Midge	LARVA–STATE L1	24 H	LC_{50}	3,180		215356	89
	Chironomus riparius; Midge	LARVA–STATE L3	72 H	LC_{50}	230		215356	89
	Chironomus riparius; Midge	LARVA–STATE L2	72 H	LC_{50}	260		215356	89
	Chironomus riparius; Midge	LARVA–STATE L2	48 H	LC_{50}	820		215356	89
	Chironomus riparius; Midge	LARVA–STATE L4	48 H	LC_{50}	790		215356	89
	Chironomus riparius; Midge	LARVA–STATE L2	24 H	LC_{50}	1,960		215356	89
	Chironomus riparius; Midge	LARVA–STATE L3	96 H	LC_{50}	230		215356	89
	Chironomus riparius; Midge	LARVA–STATE L1	24 H	LC_{50}	1,690		215356	89
	Chironomus riparius; Midge	LARVA–STATE L3	48 H	LC_{50}	240		215356	89
	Chironomus riparius; Midge	EGGS	<=24 H	MOR *	10,000		215356	89
	Chironomus riparius; Midge	LARVA–STATE L2	96 H	LC_{50}	220		215356	89
	Chironomus riparius; Midge	EGGS	7 to 96 H	MOR *	320		215356	89
	Chironomus riparius; Midge	LARVA–STATE L4	24 H	LC_{50}	4,800		215356	89
	Chironomus riparius; Midge	EGGS	<=24 H	MOR *	3,200		215356	89
	Chironomus riparius; Midge	LARVA–STATE L3	24 H	LC_{50}	750		215356	89
	Chironomus riparius; Midge	LARVA–STATE L4	96 H	LC_{50}	480		215356	89
	Chironomus riparius; Midge	LARVA–STATE L4	72 H	LC_{50}	710		215356	89
	Chironomus riparius; Midge	EGGS	7 to 96 H	MOR *	320		215356	89
	Chironomus tentans; Midge	LARVA–STATE L1	24 H	LC_{50}	2,280		215356	89
	Chironomus tentans; Midge	LARVA–STATE L3	96 H	LC_{50}	280		215356	89
	Chironomus tentans; Midge	LARVA–STATE L3	48 H	LC_{50}	6,700		215356	89
	Chironomus tentans; Midge	LARVA–STATE L2	48 H	LC_{50}	8,040		215356	89
	Chironomus tentans; Midge	LARVA–STATE L2	24 H	LC_{50}	23,400		215356	89
	Chironomus tentans; Midge	LARVA–STATE L4	72 H	LC_{50}	3,040		215356	89
	Chironomus tentans; Midge	LARVA–STATE L3	24 H	LC_{50}	29,600		215356	89
	Chironomus tentans; Midge	LARVA–STATE L4	24 H	LC_{50}	32,300		215356	89
	Chironomus tentans; Midge	LARVA–STATE L2	96 H	LC_{50}	240		215356	89
	Chironomus tentans; Midge	LARVA–STATE L4	96 H	LC_{50}	570		215356	89
	Chironomus tentans; Midge	LARVA–STATE L3	72 H	LC_{50}	580		215356	89
	Chironomus tentans; Midge	LARVA–STATE L4	48 H	LC_{50}	6,860		215356	89
	Chironomus tentans; Midge	LARVA–STATE L2	72 H	LC_{50}	570		215356	89
	Chironomus thummi; Midge	LARVAE	7 D	LET	3,500		210725	57
	Cyclops sp; Cyclopoid copepod	ADULT	48 H	LC_{50}	600		313255	88
	Cyprinidae; Minnow, carp family	1 SUMMER	7 D	MOR *	300		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	7 D	MOR *	700		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	60 H	LET *	1,000		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	8.5 H	LET *	5,000		210725	57

Table O.1–9
AQUIRE Freshwater Toxicity Information ($\mu g/L$)
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration Lethal	Effect Concentration Sublethal	AQUIRE Reference Number	Year of Publication
Mercury (cont.)	Cyprinidae; Minnow, carp family	1 SUMMER	24.25 H	LET *	1,500		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	84 H	LET *	800		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	2.5 H	LET *	75,000		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	7 D	MOR *	290		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	4.5 H	LET *	50,000		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	7 D	MOR *	500		210725	57
	Cyprinidae; Minnow, carp family	2 SUMMERS	58 H	LET *	4,500		210725	57
	Cyprinidae; Minnow, carp family	1 SUMMER	1.25 H	LET *	100,000		210725	57
	Dugesia tigrina; Turbellarian, flatworm	NR	96 H	LC_{50}	270		218709	74
	Gambusia affinis; Mosquitofish	NR	<24 H	LT_{50}	50 to 500		315524	79
	Gambusia affinis; Mosquitofish	NR	30 D	BCF *		1	315524	79
	Gambusia affinis; Mosquitofish	NR	30 D	BCF *		1	315524	79
	Gambusia affinis; Mosquitofish	NR	30 D	BCF *		1	315524	79
	Gammarus roeseli; Scud	NR	7 D	LET	100		210725	57
	Gnathonemus petersii; Electric fish	JUVENILE, 5–20 G	20 H	PHY *		100	310685	84
	Lamellidens marginalis; Mussel	5.0–6.0 CM	1 to 30 D	OC		500 to 2,000	213776	91
	Lamellidens marginalis; Mussel	5.0–6.0 CM	96 H	LC_{50}	5,000		213776	91
	Lamellidens marginalis; Mussel	NR	96 H	LC_{50}	10,000		213311	89
	Lamellidens marginalis; Mussel	5.0–6.0 CM	1 to 30 D	GRO		500 to 2,000	213776	91
	Lamellidens marginalis; Mussel	7 CM	3. to 6.5 H	PHY *		500 to 2,000	213311	89
	Lamellidens marginalis; Mussel	32 G	48 H	OC *		5,910	311622	84
	Myriophyllum spicatum; Water–milfoil	4 CM APEX	32 D	EC_{50}GR *		1,200	212262	74
	Myriophyllum spicatum; Water–milfoil	4 CM APEX	32 D	EC_{50}BM *		3,400	212262	74
	Myriophyllum spicatum; Water–milfoil	4 CM APEX	32 D	EC_{50}GR *		12,000	212262	74
	Myriophyllum spicatum; Water–milfoil	4 CM APEX	32 D	EC_{50}BM *		4,400	212262	74
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	11 H	LET *	500		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	7 D	MOR *	150		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	2 SUMMERS	24 H	LET *	500		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	5.33 D	LET *	250		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	5.8–15.6 CM, 1.7–52.5 G	2 to 209 D	RSD		48,200	210503	71
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	13.67 H	LET *	350		210725	57
	Oncorhynchus mykiss; Rainbow trout, donaldson trout	1 SUMMER	8.17 H	LET *	800		210725	57
	Planaria sp; Planarian, flatworm	NR	6.6 H	LT_{50}	500		218981	73
	Potamogeton crispus; Curled pondweed	NR	NR	PSE *		5,000	217552	77
	Salvelinus fontinalis; Brook trout	1 SUMMER	7 D	MOR *	250		210725	57
	Salvelinus fontinalis; Brook trout	2 SUMMERS	88 H	LET *	500		210725	57
	Salvelinus fontinalis; Brook trout	1 SUMMER	21 H	LET *	350		210725	57
	Salvelinus fontinalis; Brook trout	1 SUMMER	18 H	LET *	500		210725	57
	Salvelinus fontinalis; Brook trout	1 SUMMER	4.25 D	LET *	300		210725	57
	Salvelinus fontinalis; Brook trout	1 SUMMER	16.33 H	LET *	800		210725	57
	Tilapia mossambica; Mozambique tilapia	7–10 CM, 6–10 G	1 WK	HEM *		4,000	212931	87
	Tilapia mossambica; Mozambique tilapia	7.0–11.8 CM	11 WK	BIO *		10	310166	84
	Tinca tinca; Tench	1 SUMMER	72 H	LET *	1,500		210725	57
	Tinca tinca; Tench	1 SUMMER	7 D	MOR *	1,000		210725	57
	Tinca tinca; Tench	1 SUMMER	7.17 D	LET *	1,100		210725	57
	Tinca tinca; Tench	1 SUMMER	12.58 H	LET *	5,000		210725	57
	Tinca tinca; Tench	1 SUMMER	4.5 H	LET *	50,000		210725	57
	Tinca tinca; Tench	1 SUMMER	4.25 D	LET *	1,300		210725	57
	Tinca tinca; Tench	2 SUMMERS	4.3 D	LET *	1,500		210725	57
	Tubifex tubifex; Tubificid worm	NR	7 D	LET	300		210725	57

Table O.1–9
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Selenium	Brachionus calyciflorus; Rotifer	NEONATE	24 H	LC_{50}	16,000		219385	91
	Chironomus riparius; Midge	<24 H	30 D	DVP *		6 to 6,050	210956	90
	Chironomus riparius; Midge	<24 H	48 H	EC_{50}IM ?		1,790	210956	90
	Chironomus riparius; Midge	<24 H	48 H	EC_{50}IM ?		14,300	210956	90
	Daphnia magna; Water flea	<24 H	21 D	BCF *		711	210956	90
	Daphnia magna; Water flea	<24 H	21 D	BCF *		348	210956	90
	Daphnia magna; Water flea	<=24 H OLD	48 H	LC_{50}	430		215184	80
	Daphnia magna; Water flea	MIDDLE INSTAR	48 H	LC_{50}	710		210486	80
	Daphnia magna; Water flea	<24 H	21 D	MOR *	711		210956	90
	Daphnia magna; Water flea	MIDDLE INSTAR	96 H	LC_{50}	430		210486	80
	Daphnia magna; Water flea	<24 H	21 D	REP *		156	210956	90
	Daphnia magna; Water flea	MIDDLE INSTAR	14 D	LC_{50}	430		210486	80
	Daphnia magna; Water flea	<= 24 H	48 H	MOR *	220		215184	80
	Daphnia magna; Water flea	2 D	to 3 WK	REP *		280	210486	80
	Daphnia magna; Water flea	<24 H	21 D	BCF *		85	210956	90
	Daphnia magna; Water flea	<24 H	21 D	BCF *		156	210956	90
	Daphnia magna; Water flea	<24 H	48 H	EC_{50}IM ?		2,620	210956	90
	Daphnia magna; Water flea	<24 H	21 D	MOR *	1,410		210956	90
	Daphnia magna; Water flea	2 D	to 3 WK	MOR *	280		210486	80
	Daphnia magna; Water flea	<24 H	21 D	BCF *		5	210956	90
	Daphnia magna; Water flea	<24 H	21 D	REP *		348	210956	90
	Daphnia magna; Water flea	<=24 H OLD	24 H	LC_{50}	660		215184	80
	Daphnia magna; Water flea	<24 H	48 H	EC_{50}IM ?		9,340	210956	90
	Dugesia dorotocephala; Turbellarian, flatworm	18–20 MM	1 H	BEH *		1,000 to 10,000	310581	91
	Hyalella azteca; Scud	ADULT	96 H	LC_{50}	340		210486	80
	Hyalella azteca; Scud	ADULT	48 H	LC_{50}	940		210486	80
	Hyalella azteca; Scud	ADULT	14 D	LC_{50}	70		210486	80
	Lemna minor; Duckweed	20 COLONIES OR 40 FRONDS	4 D	EC_{50}GR		2,400	311789	86
	Lepomis macrochirus; Bluegill	JUVENILE, 40–70 MM TOTAL LENGTH	48 H	RES *		5	310565	83
	Micropterus salmoides; Largemouth bass	JUVENILE, 40–70 MM TOTAL LENGTH	48 H	RES *		5	310565	83
	Oncorhynchus kisutch; Coho salmon, silver salmon	FRY, 0.7 G	96 H	LC_{50}	16,900		213174	90
	Oncorhynchus kisutch; Coho salmon, silver salmon	FRY, 0.5 G	96 H	LC_{50}	24,500		213174	90
	Oncorhynchus kisutch; Coho salmon, silver salmon	FRY, 0.5 G	96 H	LC_{50}	25,800		213174	90
	Oncorhynchus kisutch; Coho salmon, silver salmon	FRY, 0.5 G	96 H	LC_{50}	21,800		213174	90
	Oncorhynchus tshawytscha; Chinook salmon	FRY, 0.5 G	96 H	LC_{50}	46,600		213174	90
	Oncorhynchus tshawytscha; Chinook salmon	FRY, 0.5 G	96 H	LC_{50}	85,500		213174	90
	Oncorhynchus tshawytscha; Chinook salmon	FRY, 0.5 G	96 H	LC_{50}	50,900		213174	90
	Oncorhynchus tshawytscha; Chinook salmon	FRY, 0.6 G	96 H	LC_{50}	67,100		213174	90
	Pimephales promelas; Fathead minnow	2 D, EGG	62 H *	LT_{50}	1,000		210486	80
	Pimephales promelas; Fathead minnow	2 D, EGG	33 H *	LT_{50}	1,500		210486	80
	Pimephales promelas; Fathead minnow	2 D, EGG	17 D	DVP *		10,000	210486	80
	Pimephales promelas; Fathead minnow	2 D, EGG	85 H *	LT_{50}	5		210486	80
	Pimephales promelas; Fathead minnow	2 D, EGG	17 D	HAT *		40,000	210486	80
	Pimephales promelas; Fathead minnow	59–61 D	1 to 98 D	GRO		5,000 to 30,000	213930	89
	Pimephales promelas; Fathead minnow	2 D, EGG	14 H *	LT_{50}	30,000		210486	80
	Pimephales promelas; Fathead minnow	59–61 D	98 D			5,000 to 30,000	213930	89
	Pimephales promelas; Fathead minnow	2 D, EGG	25 H *	LT_{50}	20,000		210486	80
	Pimephales promelas; Fathead minnow	2 D, EGG	120 H *	LT_{50}	1		210486	80
	Pimephales promelas; Fathead minnow	2 D, EGG	12 H *	LT_{50}	40		210486	80
	Pimephales promelas; Fathead minnow	2 D, EGG	17 D	DVP *		15,000	210486	80
	Pimephales promelas; Fathead minnow	2 D, EGG	11 H *	LT_{50}	25,000		210486	80

Table O.1-9
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
Selenium (cont.)	Pimephales promelas; Fathead minnow	FRY, 0.03 G, 17 MM, 25-35 D	14 D	LC_{50}	600		210486	80
	Pimephales promelas; Fathead minnow	FRY, 0.03 G, 17 MM, 25-35 D	96 H	LC_{50}	1,000		210486	80
Vanadium oxide sulfate	Carassius auratus; Goldfish	3-5 CM, 0.3-2.9 G	6 D	LC_{50}	1,020		228999	79
	Lepomis macrochirus; Bluegill	NR	96 H	LC_{50}	6,000		287133	60
	Pimephasles promelas; Fathead minnow	NR	96 H	LC_{50}	4,800		287131	60
	Poecilia reticulata; Guppy	1.5-2.5 CM, 0.1-0.5 G	6 D	LC_{50}	$\boxed{128}$		229000	79
Zinc	Algae; Algae, phytoplankton, algal mat;	CLADOCERA, COPEPODA, ROTIFERA	2 WK	CLR *		15 to 30	311256	83
	Algae; Algae, phytoplankton, algal mat;	EXPO GRO PHASE	24 H	PSE		<=98100	213095	89
	Asellus communis; Aquatic sowbug;	NR	20 D	RSD *		0.11 to 0.12	312027	86
	Brachionus calyciflorus; Rotifer;	NEONATE	24 H	LC_{50}	1,300		219385	91
	Canthocamptus sp; Copepod;	LARVAE	24 H	LET	1,250		311797	85
	Carassius auratus; Goldfish;	20-25G	to 15 D	BIO *		500	219207	72
	Catostomus commersoni; White sucker;	JUVENILE, 142 MM, 28.7 G	1 WK	RSD		890	312412	87
	Ceriodaphnia reticulata; Water flea;	< 4 H	48 H	LC_{50}	76		311181	84
	Channa punctatus; Snake-head catfish;	2.4 G, 58 MM	24 H	ENZ *		56,000	315190	81
	Chironomidae; Midge family;	LARVAE	12 MO	POP		1,140	213176	88
	Chironomus riparius; Midge;	4TH INSTAR LARVAE	>10 D	RSD		50 to 100	212729	89
	Clarias lazera; Catfish;	IMMATURE, 12-15G	2 to 96 H	BIO *		32,000	312716	87
	Clarias lazera; Catfish;	JUVENILE, 230 MM, 130 G	24 H	RSD *		15,000	312717	87
	Cyclops sp; Cyclopoid copepod;	ADULT	48 H	LC_{50}	3,310		313255	88
	Cypris subglobosa; Ostracod;	NR	12 H	LC_{50}	47,780		312365	88
	Cypris subglobosa; Ostracod;	NR	24 H	LC_{50}	50,620		312365	88
	Cypris subglobosa; Ostracod;	NR	48 H	LC_{50}	34,990		312365	88
	Cypris subglobosa; Ostracod;	NR	96 H	LC_{50}	8,352		312365	88
	Daphnia lumholzi; Water flea;	NR	12 H	LC_{50}	10,740		312365	88
	Daphnia lumholzi; Water flea;	NR	24 H	LC_{50}	6,704		312365	88
	Daphnia lumholzi; Water flea;	NR	48 H	LC_{50}	2,290		312365	88
	Daphnia lumholzi; Water flea;	NR	96 H	LC_{50}	437.5		312365	88
	Daphnia magna; Water flea;	24-48 HR, NEONATE	21 D	GRO *		150	213950	91
	Daphnia magna; Water flea;	24-48 HR, NEONATE	21 D	MOR	50 to 150		213950	91
	Daphnia magna; Water flea;	24-48 HR, NEONATE	21 D	REP *		150	213950	91
	Daphnia magna; Water flea;	< 24 H	48 H	LC_{50}	68		311181	84
	Daphnia pulex; Water flea;	< 24 H	48 H	LC_{50}	107		311181	84
	Dugesia dorotocephala; Turbellarian, flatworm;	18-20 MM	1 H	BEH *		1,000 to 10,000	310581	91
	Dugesia tigrina; Turbellarian, flatworm;	NR	96 H	LC_{50}	7,400		218709	74
	Gambusia affinis; Mosquitofish;	MIXED SIZES	to 30 D	RSD		50	312897	88
	Gambusia affinis; Mosquitofish;	NR	48 H	LC_{50} ?	116		315578	78
	Gammarus lacustris; Scud;	NR	96 H	LC_{50}	2,240		313058	88
	Gomphonema parvulum; Diatom;	MIXED SPECIES	to 28 D	ABD *		1,000	212397	84
	Hyphessobrycon serpae; Serpa tetra;	JUVENILE & OLDER FISH	14 D	RSD		66,000	212709	78
	Invertebrates; Invertebrates;	CLADOCERA, COPEPODA, ROTIFERA	2 WK	POP *		$\boxed{17.1 \text{ to } 89.6}$	311256	83
	Invertebrates; Invertebrates;	CLADOCERA, COPEPODA, ROTIFERA	2 WK	POP *		30 to 90	311256	83
	Lemna minor; Duckweed;	20 COLONIES OR 40 FRONDS	4 D	EC_{50}GR		10,000	311789	86
	Lepomis gibbosus; Pumpkinseed;	15-25G	to 15 D	BIO *		500	219207	72
	Lepomis macrochirus; Bluegill;	NR	6 MO	MOR *	5,000		212143	73
	Limnodrilus sp; Sludge worm;	NR	14 D	RSD		1,000	311865	83
	Lophopodella carteri; Bryozoa;	ANCENSTRULAE, 2-3 D	96 H	LC_{50}	5,630		216703	80
	Macrobrachium hendersodayanus; Prawn;	NR	96 H	OC *		7,870	311545	84
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}BM *		21,600	2122[illegible]	74

Table O.1-9
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Chemical Name	Species	Age	Exposure	Effect	Effect Concentration		AQUIRE Reference Number	Year of Publication
					Lethal	Sublethal		
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}GR *		20,900	212262	74
	Myriophyllum spicatum; Water-milfoil;	4 CM APEX	32 D	EC_{50}GR *		21,600	212262	74
	Mystus vittatus; Catfish;	80-100 MM, 6-10 G	96 H	LC_{50} ?	209,000		315793	82
Zinc (cont.)	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	20-50 G	6 H	PHY *		2,000	311200	82
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	FINGERLING	12 D	RSD *		910 to 2,320	311689	86
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	JUVENILE	to 4 WK	BIO		44 to 140	310107	84
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NR	48 H	LC_{50}	2,600		310185	68
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NR	48 H	LC_{50}	2,800		218317	68
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	NR	48 H	LC_{50}	3,500		218317	68
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	SAC-FRY	42 D	GRO *		430	310527	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	SAC-FRY	42 D	MOR *	120		310527	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	SAC-FRY	42 D	MOR *	430		310527	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	SAC-FRY	42 D	MOR * (Calc)	220		310527	83
	Oncorhynchus mykiss; Rainbow trout, donaldson trout;	SAC-FRY	42 D	MOR * (Calc)	80		310527	83
	Osteichthyes; Bony fish class;	ADULT GUPPY, 20-30 MM	48 H	LC_{50}	2,630		212882	88
	Osteichthyes; Bony fish class;	ADULT GUPPY, 20-30 MM	96 H	LC_{50}	1,860		212882	88
	Osteichthyes; Bony fish class;	JUVENILE GUPPY, 8-15 MM	48 H	LC_{50}	1,970		212882	88
	Osteichthyes; Bony fish class;	JUVENILE GUPPY, 8-15 MM	96 H	LC_{50}	1,360		212882	88
	Pectinatella magnifica; Bryozoa;	ANCENSTRULAE, 2-3 D	96 H	LC_{50}	4,310		216703	80
	Phaenopsectra sp; Chironomid;	MIXED SPECIES	to 28 D	ABD *		10,000	212397	84
	Pimephales promelas; Fathead minnow;	NEWLY HAT, < 24 H	7 D	GRO *		184	311182	85
	Pimephales promelas; Fathead minnow;	NEWLY HAT, < 24 H	7 D	GRO *		85	311182	85
	Pimephales promelas; Fathead minnow;	NEWLY HAT, < 24 H	7 D	LC_{50}	238		311182	85
	Pimephales promelas; Fathead minnow;	NEWLY HAT, < 24 H	96 H	LC_{50}	238		311182	85
	Pimephales promelas; Fathead minnow;	SUBADULT, 8-12 WK, <=250 MG	2 to 35 D	GRO *		600	210678	89
	Pimephales promelas; Fathead minnow;	SUBADULT, 8-12 WK, <=250 MG	96 H	LC_{50}	2,540		210678	89
	Plumatella emarginata; Bryozoan;	ANCENSTRULAE, 2-3 D	96 H	LC_{50}	5,300		216703	80
	Salmo trutta; Brown trout;	NR	2 to 40 D	RSD		366 to 832	311216	85
	Tilapia sparrmanii; Banded bream;	12.13-81.77 G	2 to 72 H	OC *		98,000	213066	89
	Tilapia zillii; Tilapia;	IMMATURE, 7-9 G	2 to 96 H	BIO *		22,000	312716	87
	Tubifex sp; Tubificid worm;	NR	14 D	RSD		1,000	311865	83

NOTES:

ABD = Abundance
ABN = Abnormalities
BCF = Bioconcentration factor
BEH = Behavioral change
BIO = Biochemical effect
BM = Biomass
BMS = Biomass
C = Celcius
CLR = Chlorophyll content
CM = Centimeter
D = Days
EC_{50} = Effect of concentration to 50% of the population
EMS = Emergance?
ENZ = Enzyme effect
F = Farenheit

G = Grams
GR = Growth
GRO = Growth
H = Hours
HAT = Hatchability
HEM = Hematological effect
HIS = Histological effect
IM = Immobilization
LC_{50} = Lethal concentration to 50% of test organisms
LET = Lethality
LOC = Locomotor Behaviour
LT_{50} = Lethal threshold to 50% of test organisms
MM = Millimeter
MOR = Mortality
NR = Not reported

OC = Oxygen consumption
PGR = Population growth
PHY = Physiological effects
POP = Population, species diversity
PSE = Photosynthesis effect
RE = Reproduction
REP = Adverse effect to reproduction
RES = Respiratory effects
RN = Renewel
RSD = Residue
ST = Static
STR = Stress
THL = Thermal effect
VTE = Vertebral effect
$\mu g/L$ = Microgram per liter

= Lowest effect concentration (if a range is provided, the low end of the range is the lowest effect concentration).

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Chemical Name	Species Identification (Organism)	Age/Life Stag	Exposure Regimen	Effects Concentration	Effect	Source
INORGANIC COMPOUNDS						
Aluminum	Bufo americanus; American toad	Tadpole	96 h	0.627 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo americanus; American toad	Tadpole	96 h	0.859 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo americanus; American toad	Tadpole	96 h	1.379 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo americanus; American toad	Tadpole	96 h	1.663 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo americanus; American toad	Tadpole	96 h	>1.762 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	Embryo	96 h	0.811 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	Embryo	96 h	0.403 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	Embryo	96 h	>0.856 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	Embryo	96 h	>1 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	Embryo	96 h	>0.980 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	Embryo	96 h	>1.018 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	Embryo	96 h	0.471 mg/L	LC_{50}	ECOTOX
Aluminum chloride	Microhyla carolinensis; Narrow mouthed fro	Eggs	7 d	0.050 mg/L	LC_{50}	AQUIRE; 215305
	Ambystoma opacum; Marbled salamander	Eggs	8 d	2.28 mg/L	LC_{50}	AQUIRE; 216199
Beryllium Sulfate	Ambystoma maculatum; Spotted salamand	Larva	24, 48, and	31.5 mg/L Be	TL_{50}	Devillers & Exbrayat, 1992
	Ambystoma maculatum; Spotted salamand	Larva	96 h	3.15 mg/L Be	TL_{50}	Devillers & Exbrayat, 1992
	Ambystoma maculatum; Spotted salamand	Larva	24, 48, and	18.2 mg/L Be	TL_{50}	Devillers & Exbrayat, 1992
	Ambystoma maculatum; Spotted salamand	Larva	96 h	8.02 mg/L Be	TL_{50}	Devillers & Exbrayat, 1992
	Ambystoma maculatum; Spotted salamand	Larva	48 and 96	18.2 mg/L Be	TL_{50}	Devillers & Exbrayat, 1992
	Ambystoma maculatum; Spotted salamand	Larva	96 h	8.32 mg/L Be	TL_{50}	Devillers & Exbrayat, 1992
	Ambystoma maculatum; Spotted salamand	Larva	24 h	6.83 mg/L Be	TL_{50}	ECOTOX
	Ambystoma maculatum; Spotted salamand	Larva	48 h	4.21 mg/L BE	LC_{50}	ECOTOX
	Ambystoma maculatum; Spotted salamand	Larva	24 and 48	>10 mg/L Be	TL_{50}	ECOTOX
	Ambystoma maculatum; Spotted salamand	Larva	24 h	21.2 mg/L	TL_{50}	ECOTOX
	Ambystoma opacum; Marbled salamander	Larva	24, 48, and	31.5 mg/L Be	TL_{50}	Devillers & Exbrayat, 1992
	Ambystoma opacum; Marbled salamander	Larva	96 h	3.15 mg/L Be	TL_{50}	Devillers & Exbrayat, 1992
	Ambystoma opacum; Marbled salamander	Larva	24 h	23.7 mg/L Be	TL_{50}	ECOTOX
	Ambystoma opacum; Marbled salamander	Larva	48 h	4.21 mg/L Be	TL_{50}	ECOTOX
Cadmium Acetate	Notophthalmus viridescens; Eastern newt	NA	25 d	3.5 mg/L	Mortality	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	25 d	4.0 mg/L	Mortality	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	25 d	4.5 mg/L	Mortality	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	25 d	2.0 mg/L	Mortality	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	25 d	2.5 mg/L	Mortality	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	25 d	3.0 mg/L	Mortality	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	51 d	2.25 mg/L	Mortality	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	51 d	4.5 mg/L	Mortality	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	51 d	6.75 mg/L	Mortality	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	60 d	2.0 mg/L	Regeneration capabilities	AQUIRE
	Notophthalmus viridescens; Eastern newt	NA	76 d	2.25 mg/L	Regeneration capabilities	AQUIRE

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Chemical Name	Species Identification (Organism)	Age/Life Stag	Exposure Regimen	Effects Concentration	Effect	Source
Cadimum Chloride	Xenopus laevis; Clawed toad	3-4 weeks	48 h	3.2 mg/L Cd^{2+}	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	2 days	100 d	1.5 mg/L Cd^{2+}	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma opacum; Marbled salamander	NA	8 d	0.15 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	24 h	3.41 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	24 h	4.05 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	24 h	4.76 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	24 h	9.92 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	48 h	2.55 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	48 h	3.15 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	48 h	3.4 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	48 h	8.6 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	72 h	2.32 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	72 h	2.87 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	72 h	3.11 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	72 h	7.84 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	96 h	2.19 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	96 h	2.65 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	96 h	3.06 mg/L	LC_{50}	AQUIRE
	Bufo arenarum; Argentine toad	NA	96 h	6.77 mg/L	LC_{50}	AQUIRE
	Rana pipiens; Northern leopard frog	NA	1-2 d	0.307 mg/L	Mortality	AQUIRE
	Rana pipiens; Northern leopard frog	NA	1 d	0.307 mg/L	Mortality	AQUIRE
	Rana pipiens; Northern leopard frog	NA	1 d	3.068 mg/L	Mortality	AQUIRE
	Rana pipiens; Northern leopard frog	NA	1 d	4.602 mg/L	Mortality	AQUIRE
	Rana pipiens; Northern leopard frog	NA	1 d	6.135 mg/L	Mortality	AQUIRE
Cadmium Nitrate	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	1.3 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	1.10 mg/L	NOLC	Devillers & Exbrayat, 1992
	Ambystoma mexicanum; Axolotl	NA	48 h	0.62 mg/L	LC_{50}	AQUIRE
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	32 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	20.2 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	23 mg/L	NOLC	Devillers & Exbrayat, 1992
Chromium	Gastrophryne carolinensis; Narrow-mouthed toad	Embryo	96 h	0.03 mg/L	LC_{50}	Birge et al., 1979
Cobalt	Gastrophryne carolinensis; Narrow-mouthed toad	Embryo	96 h	0.05 mg/L	LC_{50}	Birge et al., 1979
Copper	Gastrophryne carolinensis; Narrow-mouthed toad	Embryo	96 h	0.04 mg/L	LC_{50}	Birge et al., 1979
Copper Sulfate	Xenopus laevis; Clawed toad	3-4 weeks	48 h	1.7 mg/L	LC_{50}	Devillers & Exbrayat, 1992

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Chemical Name	Species Identification (Organism)	Age/Life Stag	Exposure Regimen	Effects Concentration	Effect	Source
Lead	Bufo americanus; American toad	Tadpole	6 d	0.5 - 1.0 mg/L	Mortality	AQUIRE
	Bufo americanus; American toad	Embryo	48 h	0.47 - 0.90 mg/L Pb^{2+}	LC_{50}	ECOTOX
	Bufo arenarum; Argentine toad	NA	24 h	1.0 mg/L	Emergence	AQUIRE
	Bufo arenarum; Argentine toad	NA	24 h	1.0 mg/L	Mortality	AQUIRE
	Gastrophryne carolinensis; Narrow-mouthed toad	Embryo	96 h	0.04 mg/L	LC_{50}	Birge et al., 1979
Lead Chloride	Ambystoma opacum; Marbled salamander	NA	8 d	1.46 mg/L	LC_{50}	AQUIRE
Lead Nitrate	Bufo arenarum; Argentine toad	Embryo	48 h	0.47-0.9 mg/L Pb^{2+}	LC_{50}	Devillers & Exbrayat, 1992
	Rana catesbeiana; Bullfrog	NA	6 d	0.5 - 1.0 mg/L	Locomotor behavior	AQUIRE
	Rana clamitans; Green frog	NA	1-6 d	0.75 mg/L	Behavior	AQUIRE
Magnesium [f]						
Manganese	Gastrophryne carolinensis; Narrow-mouthed toad	Embryo	96 h	1.42 mg/L	LC_{50}	Birge et al., 1979
Mercury	Bufo fowleri; Fowler's toad	Embryo/Larva	96 h [b]	0.0659 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo punctatus; Red spotted toad	Embryo/Larva	96 h [b]	0.0368 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Gastrophryne carolinensis; Narrow-mouthed toad	Embryo/Larva	96 h [b]	0.0013 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Hyla chrysoscelis; Gray treefrog	Embryo/Larva	96 h [b]	0.0024 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana grylio; Pig frog	Embryo/Larva	96 h [b]	0.0672 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	Embryo/Larva	96 h [b]	0.0073 mg/L	LC_{50}	Devillers & Exbrayat, 1992
Mercury chloride	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	0.4 mg/L	LC_{50}	ECOTOX
	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	0.27 mg/L	NOLC	ECOTOX
Nickel	Gastrophryne carolinensis; Narrow-mouthed toad	Embryo	96 h	0.05 mg/L	LC_{50}	Birge et al., 1979
Silver nitrate	Ambystoma opacum; Marbled salamander	NA	8 d	0.24 mg/L	LC_{50}	AQUIRE
Zinc	Gastrophryne carolinensis; Narrow-mouthed toad	Embryo	96 h	0.01 mg/L	LC_{50}	Birge et al., 1979
	Xenopus laevis; Clawed toad	Embryo	96 h	34.5 mg/L Zn	LC_{50}	Devillers & Exbrayat, 1992
Zinc Chloride	Ambystoma opacum; Marbled salamander	NA	8 d	2.38 mg/L	LC_{50}	AQUIRE
PESTICIDES/PCBs						
4,4'-DDD	Bufo woodhousei fowleri; Fowler's toad	Tadpole	96 h	0.140 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo woodhousei fowleri; Fowler's toad	Tadpole	24 h	0.709 mg/L	LC_{50}	ECOTOX
4,4'-DDT	Bufo woodhousei fowleri; Fowler's toad	Tadpole 6 wks	96 h	0.10 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo woodhousei fowleri; Fowler's toad	Tadpole 7 wks	96 h	0.03 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana temporaria; Common/Grass frog	Adults	20 d	7.6 mg/kg (dose)	LD_{50}	Devillers & Exbrayat, 1992

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Aldrin	Bufo woodhousei fowleri; Fowler's toad	Tadpole	96 h	0.068 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	3.5 in/ 65 g	30 d	0.30 mg/L	40% Mortality	Devillers & Exbrayat, 1992
Aroclor 1242	Bufo americanus; American toad	Embryo/Larva	96 h [b]	0.00271 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo fowleri; Fowler's toad	Embryo/Larva	96 h [b]	0.01209 mg/L	LC_{50}	Devillers & Exbrayat, 1992
Aroclor 1254	Bufo americanus; American toad	Embryo/Larva	96 h [b]	0.00202 mg/L	LC_{50}	AQUIRE; 216772
	Bufo fowleri; Fowler's toad	Embryo/Larva	96 h [b]	0.00374 mg/L	LC_{50}	AQUIRE; 216772
	Pleurodeles waltl; Iberian ribbed newt	Larvae, 32 mm	12 d	0.025 to 0.050 mg/L	Cytogenetic effects	AQUIRE; 219976
	Bufo woodhousei fowleri; Fowler's toad	Egg, 2-6 h	7 to 96 h	0.03818 mg/L	LC_{50}	AQUIRE; 216772
	Bufo americanus; American toad	Egg, 2-6 h	7 to 96 h	0.01032 mg/L	LC_{50}	AQUIRE; 216772
	Bufo woodhousei fowleri; Fowler's toad	Embryo to larv	to 8 d	0.00374 mg/L	LC_{50}	AQUIRE; 216772
	Bufo americanus; American toad	Embryo to larv	to 8 d	0.00202 mg/L	LC_{50}	AQUIRE; 216772
gamma-BHC (Lindane)	Bufo woodhousei fowleri; Fowler's toad	Tadpole	96 h	3.2 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Microhyla ornata; Ornate chorus frog	Yolk plug-stage	96 h	23.37 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Microhyla ornata; Ornate chorus frog	Tadpole, 8d	96 h	7.270 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Microhyla ornata; Ornate chorus frog	Yolk plug-stage	96 h	20 mg/L	47% Mortality	Devillers & Exbrayat, 1992
	Microhyla ornata; Ornate chorus frog	Yolk plug-stage	48 h	20 mg/L	52% Hatch abnormality	Devillers & Exbrayat, 1992
	Microhyla ornata; Ornate chorus frog	Yolk plug-stage	96 h	10 mg/L	12.5% Hatch abnormality	Devillers & Exbrayat, 1992
	Pseudacris triseriata; Chorus frog	tadpole	96 h	2.65 mg/L	LC_{50}	Devillers & Exbrayat, 1992
Chlordane	Rana pipiens; Northern leopard frog	3.5in / 65 g	30 d	0.50 mg/L	40% Mortality	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	65 g	30 d	<0.38 mg/L	Mortality	ECOTOX
Dieldrin	Bufo woodhousei fowleri; Fowler's toad	Tadpole	96 h	0.15 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Pseudacris triseriata; Chorus frog	Tadpole	96 h	0.10 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	3.5in / 65 g	30 d	0.10 mg/L	50% Mortality	Devillers & Exbrayat, 1992
Endrin	Acris crepitans; Cricket frog	Larva	96 h [e]	0.010 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Acris crepitans; Cricket frog	Larva	24 h	0.023 mg/L	EC_{50}	ECOTOX
	Ambystoma maculatum; Spotted salamand	Larva	96 h [e]	0.056 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma maculatum; Spotted salamand	Larva	24 h	0.048 mg/L	EC_{50}	ECOTOX
	Ambystoma opacum; Marbled salamander	Larva	96 h [e]	0.018 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma opacum; Marbled salamander	Larva	24 h	0.018 mg/L	EC_{50}	ECOTOX
	Bufo americanus; American toad	Larva	96 h [e]	0.010 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo americanus; American toad	Larva	24 h	0.008 mg/L	EC_{50}	ECOTOX
	Bufo woodhousei fowleri; Fowler's toad	Tadpole	96 h	0.12 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Pseudacris triseriata; Chorus frog	Tadpole	96 h [e]	0.18 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Pseudacris triseriata; Chorus frog	Tadpole	24 h	0.29 mg/L	LC_{50}	ECOTOX
	Rana catesbeiana; Bullfrog	Larva	96 h [e]	0.002 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana catesbeiana; Bullfrog	Larva	24 h	>0.040 mg/L	EC_{50}	ECOTOX
	Rana catesbeiana; Bullfrog	Tadpole	96 h	0.0025 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	3.5 in / 65 g	30 d	0.03 mg/L	30% Mortality	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Egg	24 h	0.025 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Young larva	96 h	0.006 mg/L	LC_{50}	Devillers & Exbrayat, 1992

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Endrin (cont.)	Rana sphenocephala; Southern leopard fro	Older larva	96 h	0.006 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Sub-adult	96 h	0.005 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Larva	96 h [e]	0.009 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Larva	24 h	0.013 mg/L	EC_{50}	ECOTOX
	Rana sylvatica; Wood frog	Larva	96 h [e]	0.034 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sylvatica; Wood frog	Larva	24 h	<0.016 mg/L	EC_{50}	ECOTOX
	Rana pipiens; Northern leopard frog	65 g	30 d	<0.02 mg/L	Mortality	ECOTOX
Heptachlor	Bufo woodhousei fowleri; Fowler's toad	Tadpole	96 h	0.435 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo woodhousei fowleri; Fowler's toad	Tadpole	24 h	0.844 mg/L	LC_{50}	ECOTOX
Methoxychlor	Bufo woodhousei fowleri; Fowler's toad	Tadpole 4-5 wk	48 h	0.100 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo woodhousei fowleri; Fowler's toad	Tadpole 4-5 wk	24 h	0.76 mg/L	LC_{50}	AQUIRE
	Bufo woodhousei fowleri; Fowler's toad	Tadpole 4-5 wk	48 h	0.11 mg/L	LC_{50}	AQUIRE
	Pseudacris triseriata; Chorus frog	NA	24 h	0.44 mg/L	LC_{50}	AQUIRE
	Pseudacris triseriata; Chorus frog	NA	48 h	0.42 mg/L	LC_{50}	AQUIRE
	Pseudacris triseriata; Chorus frog	NA	96 h	0.33 mg/L	LC_{50}	AQUIRE
Toxaphene	Acris crepitans; Northern cricket frog	Larva	96 h [e]	0.076 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma maculatum; Spotted salamand	Larva	96 h [e]	0.034 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma opacum; Marbled salamander	Larva	96 h [e]	0.342 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo americanus; American toad	Larva	96 h [e]	0.034 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Bufo woodhousei fowleri; Fowler's toad	Tadpole	96 h [e]	0.150 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Pseudacris triseriata; Chorus frog	Tadpole	96 h	0.390 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana catesbeiana; Bullfrog	Larva	96 h [e]	0.099 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	3.5 in / 63 g	30 d	0.060 mg/L	25% Mortality	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Egg	96 h	0.060 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Egg	96 h	0.046 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Young larva	96 h	0.168 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Young larva	96 h	0.065 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Young larva	96 h	0.032 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Sub-adult	96 h	0.378 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sphenocephala; Southern leopard fro	Larva	96 h [e]	0.130 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana sylvatica; Wood frog	Larva	96 h [e]	0.195 mg/L	LC_{50}	Devillers & Exbrayat, 1992
SEMI-VOLATILE ORGANIC COMPOUNDS						
1,2-Dibromomethane	Pleurodeles waltl; Iberian ribbed newt	Larvae, 32 mm	12 d	1 to 5 mg/L	Cytogenetic effects	AQUIRE; 219976
	Quantitative Structure-Activity Relationship	NA	NA	540 mg/L	Narcosis	Lipnick, R.L., 1989
2-Proponone	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	20,000 mg/L	LC_{50}	AQUIRE; 219740
	Quantitative Structure-Activity Relationship	NA	NA	18,000 mg/L	Narcosis	Lipnick, R.L., 1989

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Chemical Name	Species Identification (Organism)	Age/Life Stag	Exposure Regimen	Effects Concentration	Effect	Source
4-Chloroaniline	Xenopus laevis; Clawed toad	Egg stage	3 wk	100 mg/L	Lethality	AQUIRE; 212617
	Xenopus laevis; Clawed toad	Egg stage	3 wk	0.001 mg/L	32% Mortality	AQUIRE; 212617
	Quantitative Structure-Activity Relationship	NA	NA	560 mg/L	Narcosis	Lipnick, R.L., 1989
Anthracene	Rana pipiens; Northern leopard frog	Embryo	24 h [c]	0.065 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	Embryo	24 h [c]	0.11 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana pipiens; Northern leopard frog	NA	24 h [d]	0.025 mg/L	LC_{50}	ECOTOX
	Quantitative Structure-Activity Relationship	NA	NA	2.7 mg/L	Narcosis	Lipnick, R.L., 1989
Benzo(a)pyrene	Pleurodeles waltl; Iberian ribbed newt	Larva (3-4 cm)	8 d	0.01 mg/L	TDL0	Devillers & Exbrayat, 1992
	Pleurodeles waltl; Iberian ribbed newt	Larva (3-4 cm)	48 h	0.20 mg/L	physiochemical	AQUIRE
	Bufo americanus; American toad	NA	24 h	5.0 mg/L	Change in lnth and/or wt	AQUIRE
	Rana pipiens; Northern leopard frog	NA	24 h	5.0 mg/L	Change in lnth and/or wt	AQUIRE
	Quantitative Structure-Activity Relationship	NA	NA	0.16 mg/L	Narcosis	Lipnick, R.L., 1989
Bis(2-ethylhexyl)phthalate	Bufo woodhousei fowleri; Fowler's toad	Embryo to larv	to 8 d	3.880 mg/L	LC_{50}	AQUIRE; 216772
	Bufo woodhousei fowleri; Fowler's toad	Larva	96 h	3.880 mg/L	LC_{50}	AQUIRE; 216772
	Quantitative Structure-Activity Relationship	NA	NA	1.7 mg/L	Narcosis	Lipnick, R.L., 1989
Di-n-octylphthalate	Quantitative Structure-Activity Relationship	NA	NA	0.0032mg/L	Narcosis	Lipnick, R.L., 1989
Fluoranthene	Rana pipiens; Northern leopard frog	Embryo	24 h [c]	0.09 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	1.2 mg/L	Narcosis	Lipnick, R.L., 1989
Naphthalene	Xenopus laevis; Clawed toad	Larva (3 wks)	96 h	2.1 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	Larva (3 wks)	6 h	3.7 mg/L	EC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	Larva (3 wks)	6 h	2.3 mg/L	EC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	Larva (3 wks)	~2 h	4.5 mg/L	Mortality	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	13 mg/L	Narcosis	Lipnick, R.L., 1989
Nitrobenzene	Rana pipiens; Northern leopard frog	Embryo/Larva	96 h [b]	0.64 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	420 mg/L	Narcosis	Lipnick, R.L., 1989
N-Nitrosodiphenylamine	Quantitative Structure-Activity Relationship	NA	NA	57 mg/L	Narcosis	Lipnick, R.L., 1989
Pentachlorophenol	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	0.3 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	0.13 mg/L	NOLC	Devillers & Exbrayat, 1992
	Rana catesbeiana; Bullfrog	Tadpole	96 h	0.207 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	0.26 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	0.21 mg/L	NOLC	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	< 2 days	100 d	0.032 mg/L	NOLC	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	0.22 mg/L	Narcosis	Lipnick, R.L., 1989

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Chemical Name	Species Identification (Organism)	Age/Life Stag	Exposure Regimen	Effects Concentration	Effect	Source
Phenol	Ambystoma gracile;Northwestern Salaman	Embryo/Larva	96h	0.38 mg/L	LC_{50}	Black et al., 1982
	Bufo fowleri; Fowler's toad	Embryo/Larva	96h	2.45 mg/L	LC_{50}	Black et al., 1982
	Rana pipiens; Northern leopard frog	Embryo/Larva	96 h [b]	0.04 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana palustris;Pickerel frog	Embryo/Larva	96h	9.87 mg/L	LC_{50}	Black et al., 1982
	Rana temporaria; Common/Grass frog	Embryo/Larva	96h	0.27 mg/L	LC_{50}	Black et al., 1982
	Xenopus laevis; Clawed toad	Embryo/Larva	96h	7.68 mg/L	LC_{50}	Black et al., 1982
	Xenopus laevis; Clawed toad	Embryo/Larva	96h	51.1 mg/L	LC_{50}	Holcombe et al., 1987
	Quantitative Structure-Activity Relationship	NA	NA	760 mg/L	Narcosis	Lipnick, R.L., 1989
Pyrene	Rana pipiens; Northern leopard frog	Embryo	24 h [c]	0.14 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Pleurodeles waltl; Iberian ribbed newt	Larvae, 32 mm	12 d	0.035 to 0.2 (F) mg/L	Cytogenetic effects	AQUIRE; 219976
	Quantitative Structure-Activity Relationship	NA	NA	0.57 mg/L	Narcosis	Lipnick, R.L., 1989
VOLATILE ORGANIC COMPOUNDS						
Acetone	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	20,000 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	12,000 mg/L	NOLC	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	24,000 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	20,000 mg/L	NOLC	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	18,000 mg/L	Narcosis	Lipnick, R.L., 1989
Benzene	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	370 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	120 mg/L	NOLC	Devillers & Exbrayat, 1992
	Ambystoma gracile;Northwestern Salaman	Embryo/Larva	96h	5.21 mg/L	LC_{50}	Black et al., 1982
	Rana pipiens; Northern leopard frog	Embryo/Larva	96 h [b]	3.66 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	190 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	105 mg/L	NOLC	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	180 mg/L	Narcosis	Lipnick, R.L., 1989
Bromoform	Quantitative Structure-Activity Relationship	NA	NA	720 mg/L	Narcosis	Lipnick, R.L., 1989
Carbon Tetrachloride	Rana pipiens; Northern leopard frog	Embryo/Larva	96 h [b]	1.64 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Rana temporaria; Common/Grass frog	Embryo/Larva	96h	1.16 mg/L	LC_{50}	Black et al., 1982
	Ambystoma mexicanum; Axolotl	Embryo/Larva	96h	1.98 mg/L	LC_{50}	Black et al., 1982
	Rana palustris; Pickerel frog	Embryo/Larva	96h	2.37 mg/L	LC_{50}	Black et al., 1982
	Bufo woodhousei fowleri; Fowler's toad	Embryo/Larva	96h	2.83 mg/L	LC_{50}	Black et al., 1982
	Xenopus laevis; Clawed toad	Embryo/Larva	96h	22.42 mg/L	LC_{50}	Black et al., 1982
	Quantitative Structure-Activity Relationship	NA	NA	80 mg/L	Narcosis	Lipnick, R.L., 1989
Chlorobenzene	Rana pipiens; Northern leopard frog	Embryo/Larva	96 h [b]	1.2 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma gracile;Northwestern Salaman	Embryo/Larva	96h	1.15 mg/L	LC_{50}	Black et al., 1982
	Quantitative Structure-Activity Relationship	NA	NA	59 mg/L	Narcosis	Lipnick, R.L., 1989

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Chloroform	Rana pipiens; Northern leopard frog	Embryo/Larva	96 h [b]	4.16 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	340 mg/L	Narcosis	Lipnick, R.L., 1989
Dichloromethane	Rana pipiens; Northern leopard frog	Embryo/Larva	96 h [b]	>48 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	1000 mg/L	Narcosis	Lipnick, R.L., 1989
Methylene chloride	Bufo woodhousei fowleri; Fowler's toad	Embryo	7 d	> 32 mg/L	EC_{50}, teratogenesis	AQUIRE, 1996
	Bufo woodhousei fowleri; Fowler's toad	Embryo	3 d	> 32 mg/L	EC_{50}, teratogenesis	AQUIRE, 1996
	Rana catesbeiana; Bullfrog	Embryo	4 d	30.61 mg/L	EC_{50}, teratogenesis	AQUIRE, 1996
	Rana catesbeiana; Bullfrog	Embryo	8 d	17.78 mg/L	EC_{50}, teratogenesis	AQUIRE, 1996
Toluene	Rana pipiens; Northern leopard frog	Embryo/Larva	96 h [b]	0.39 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	61 mg/L	Narcosis	Lipnick, R.L., 1989
Trichloroethylene	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	48 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Ambystoma mexicanum; Axolotl	3-4 weeks	48 h	29 mg/L	NOLC	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	45 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Xenopus laevis; Clawed toad	3-4 weeks	48 h	41 mg/L	NOLC	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	160 mg/L	Narcosis	Lipnick, R.L., 1989
o-Xylene	Xenopus laevis; Clawed toad	3-4 weeks	48 h	73 mg/L	LC_{50}	Devillers & Exbrayat, 1992
	Quantitative Structure-Activity Relationship	NA	NA	25 mg/L	Narcosis	Lipnick, R.L., 1989

NOTES:
LC_{50} = The concentration at which 50% of the population died (exhibited a lethal endpoint).
LD_{50} = The administered dose which causes 50% of the population to die.
EC_{50} = The concentration at which 50% of the population exhibited an effect.
TL_{50} = Mortality endpoint; concentration represents the median tolerance limit.
NOLC = No Observed Lethal Concentration

[a] This table is intended to supplement information presented in Table O-1.9.
[b] Initiated at fertilization and maintained through 4 day posthatching.
[c] 30 minutes exposure to the sun
[d] 5 hours exposure to the sun
[e] Animals were exposed to the pesticide for 96 hours, but tabulations of mortality were made at 192 hours to account for delayed effects.
[f] Devillers & Exbrayat (1992) provides synergism data for magnesium and mercury, lead, cadmium, and manganese as % mortality.

Appendix O-1 Reference List

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O-2 ECOLOGICAL RISK CALCULATIONS

Table O-2.1
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA		ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS				BAF VALUES FOR OTHER FOOD ITEMS	
ANALYTE	RME CONCENTRATION (mg/kg)	Invert BAF [a]	Concentration in Invertebrate Tissue [b] (mg/kg)	Plant BAF [a]	Concentration in Plant Tissue [c] (mg/kg)	Small Mammal BAF [a]	Small Bird BAF [a]
Arsenic	2.1E+01	6.6E-03	1.4E-01	3.0E-01	6.3E+00	1.0E-01	6.0E-03
Cobalt	7.5E+00	1.0E+00	7.5E+00	4.0E-03	3.0E-02	1.0E+00	1.0E+00
Copper	1.6E+01	1.6E-01	2.5E+00	7.8E-01	1.2E+01	6.0E-01	6.0E-01
Manganese	4.8E+02	2.0E-02	9.6E+00	5.0E-02	2.4E+01	2.0E-02	2.0E-02
Nickel	3.1E+01	2.3E-01	7.1E+00	1.2E-02	3.7E-01	3.0E-01	3.0E-01
Selenium	8.8E-01	7.6E-01	6.7E-01	9.0E-03	7.9E-03	7.5E-01	5.1E-01
4,4'-DDE	2.0E-02	1.7E+00	3.3E-02	1.0E-02	2.0E-04	1.2E+00	2.9E+00
4,4'-DDT	2.6E-02	5.7E-01	1.5E-02	1.0E-02	2.6E-04	1.2E+00	2.9E+00
2-Methylnaphthalene	4.3E-01	5.0E-02	2.2E-02	4.9E-02	2.1E-02	1.5E-01	1.5E-01
Bis(2-ethylhexyl)phthalate	2.7E+00	5.0E-02	1.4E-01	7.6E-03	2.1E-02	2.4E-01	2.4E-01
Dibenzofuran	1.6E-01	5.0E-02	8.0E-03	3.3E-02	5.3E-03	1.5E-01	1.5E-01
Fluoranthene	3.0E-01	5.0E-02	1.5E-02	4.9E-02	1.5E-02	1.5E-01	1.5E-01
Naphthalene	4.2E-01	5.0E-02	2.1E-02	4.9E-02	2.1E-02	1.5E-01	1.5E-01
Phenanthrene	2.8E-01	5.0E-02	1.4E-02	4.9E-02	1.4E-02	1.5E-01	1.5E-01
Pyrene	4.0E-01	5.0E-02	2.0E-02	4.9E-02	2.0E-02	1.5E-01	1.5E-01
Chloroform	8.9E-04	NA	NA	NA	NA	NA	NA
Ethylbenzene	2.4E-03	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	3.0E-03	NA	NA	NA	NA	NA	NA
Toluene	3.7E-03	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	1.7E-02	NA	NA	NA	NA	NA	NA
Xylenes	2.9E-02	NA	NA	NA	NA	NA	NA

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O−2.1
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	*White−footed mouse*	*American robin*	*Red fox*	*Barred owl*
Arsenic	7.3E−01	6.1E−01	2.4E−05	9.0E−05
Cobalt	1.1E−01	3.5E−01	3.7E−05	1.9E−04
Copper	1.4E+00	1.0E+00	9.6E−05	5.6E−04
Manganese	3.9E+00	7.0E+00	2.8E−04	1.5E−03
Nickel	2.0E−01	6.0E−01	4.1E−05	1.8E−04
Selenium	1.1E−02	3.4E−02	3.1E−06	1.2E−05
4,4'−DDE	4.8E−04	1.4E−03	1.9E−07	1.6E−06
4,4'−DDT	2.7E−04	8.2E−04	1.0E−07	9.9E−07
2−Methylnaphthalene	3.6E−03	6.7E−03	3.3E−07	1.8E−06
Bis(2−ethylhexyl)phthalate	1.0E−02	3.5E−02	1.9E−06	1.2E−05
Dibenzofuran	1.1E−03	2.3E−03	1.2E−07	6.5E−07
Fluoranthene	2.5E−03	4.6E−03	2.3E−07	1.3E−06
Naphthalene	3.5E−03	6.5E−03	3.3E−07	1.8E−06
Phenanthrene	2.3E−03	4.3E−03	2.2E−07	1.2E−06
Pyrene	3.3E−03	6.2E−03	3.1E−07	1.7E−06
Chloroform	2.2E−06	9.5E−06	4.0E−10	2.6E−09
Ethylbenzene	5.9E−06	2.6E−05	1.1E−09	6.9E−09
Tetrachloroethylene	7.3E−06	3.2E−05	1.3E−09	8.7E−09
Toluene	9.1E−06	4.0E−05	1.6E−09	1.1E−08
Trichlorofluoromethane	4.2E−05	1.8E−04	7.6E−09	4.9E−08
Xylenes	7.1E−05	3.1E−04	1.3E−08	8.4E−08

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9−27).

Table O−2.1
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

Representative Wildlife Species		Percent Prey in Diet: Inverts	Plants	Small Mammals	Small Birds	Soil	Home Range (acres)	ED [f]	Site Foraging Frequency [g]	Food Ingestion Rate (kg/day)	Body Weight (kg)
White−footed mouse	(Herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0049	0.040
American robin	(Omn. bird)	33%	57%	0%	0%	10%	0.48	0.75	1.00E+00	0.011	0.077
Red fox	(Predatory mammal)	20%	10%	57%	10%	3%	1,727	1	2.90E−04	0.24	4.69
Barred owl	(Predatory bird)	3%	0%	80%	12%	5%	565	1	8.85E−04	0.047	0.72

NOTES:

SITE AREA:	0.5 acres

[e] Documentation of exposure parameters presented in: Appendix O−1, Table O−1.1
[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.
[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-2.2
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA		ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS				BAF VALUES FOR OTHER FOOD ITEMS	
ANALYTE	AVERAGE CONCENTRATION (mg/kg)	Invert BAF[a]	Concentration in Invertebrate Tissue[b] (mg/kg)	Plant BAF[a]	Concentration in Plant Tissue[c] (mg/kg)	Small Mammal BAF[a]	Small Bird BAF[a]
Arsenic	1.5E+01	6.6E−03	9.6E−02	3.0E−01	4.3E+00	1.0E−01	6.0E−03
Cobalt	4.6E+00	1.0E+00	4.6E+00	4.0E−03	1.8E−02	1.0E+00	1.0E+00
Copper	1.1E+01	1.6E−01	1.8E+00	7.8E−01	8.6E+00	6.0E−01	6.0E−01
Manganese	2.8E+02	2.0E−02	5.6E+00	5.0E−02	1.4E+01	2.0E−02	2.0E−02
Nickel	1.7E+01	2.3E−01	3.9E+00	1.2E−02	2.0E−01	3.0E−01	3.0E−01
Selenium	2.8E−01	7.6E−01	2.1E−01	9.0E−03	2.5E−03	7.5E−01	5.1E−01
4,4'−DDE	7.0E−03	1.7E+00	1.2E−02	1.0E−02	7.0E−05	1.2E+00	2.9E+00
4,4'−DDT	8.0E−03	5.7E−01	4.6E−03	1.0E−02	8.0E−05	1.2E+00	2.9E+00
2−Methylnaphthalene	2.0E−01	5.0E−02	1.0E−02	4.9E−02	9.9E−03	1.5E−01	1.5E−01
Bis(2−ethylhexyl)phthalate	1.6E+00	5.0E−02	8.0E−02	7.6E−03	1.2E−02	2.4E−01	2.4E−01
Dibenzofuran	8.3E−02	5.0E−02	4.2E−03	3.3E−02	2.7E−03	1.5E−01	1.5E−01
Fluoranthene	1.6E−01	5.0E−02	8.0E−03	4.9E−02	7.9E−03	1.5E−01	1.5E−01
Naphthalene	2.1E−01	5.0E−02	1.1E−02	4.9E−02	1.0E−02	1.5E−01	1.5E−01
Phenanthrene	1.5E−01	5.0E−02	7.5E−03	4.9E−02	7.4E−03	1.5E−01	1.5E−01
Pyrene	1.8E−01	5.0E−02	9.0E−03	4.9E−02	8.9E−03	1.5E−01	1.5E−01
Chloroform	5.3E−04	NA	NA	NA	NA	NA	NA
Ethylbenzene	1.2E−03	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	9.2E−04	NA	NA	NA	NA	NA	NA
Toluene	1.7E−03	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	7.5E−03	NA	NA	NA	NA	NA	NA
Xylenes	6.4E−03	NA	NA	NA	NA	NA	NA

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O−1, Table O−1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the average exposure concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the average exposure concentration of the CPC.

Table O-2.2
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	*White-footed mouse*	*American robin*	*Red fox*	*Barred owl*
Arsenic	5.1E-01	4.2E-01	1.7E-05	6.2E-05
Cobalt	7.0E-02	2.1E-01	2.3E-05	1.2E-04
Copper	9.7E-01	7.0E-01	6.7E-05	3.9E-04
Manganese	2.3E+00	4.1E+00	1.7E-04	8.7E-04
Nickel	1.1E-01	3.3E-01	2.3E-05	1.0E-04
Selenium	3.6E-03	1.1E-02	1.0E-06	3.9E-06
4,4'-DDE	1.7E-04	4.9E-04	6.6E-08	5.8E-07
4,4'-DDT	8.4E-05	2.5E-04	3.2E-08	3.1E-07
2-Methylnaphthalene	1.7E-03	3.1E-03	1.6E-07	8.4E-07
Bis(2-ethylhexyl)phthalate	6.2E-03	2.1E-02	1.1E-06	6.9E-06
Dibenzofuran	5.5E-04	1.2E-03	6.1E-08	3.4E-07
Fluoranthene	1.3E-03	2.5E-03	1.2E-07	6.7E-07
Naphthalene	1.8E-03	3.3E-03	1.6E-07	8.8E-07
Phenanthrene	1.3E-03	2.3E-03	1.2E-07	6.3E-07
Pyrene	1.5E-03	2.8E-03	1.4E-07	7.6E-07
Chloroform	1.3E-06	5.7E-06	2.4E-10	1.5E-09
Ethylbenzene	2.9E-06	1.3E-05	5.3E-10	3.5E-09
Tetrachloroethylene	2.3E-06	9.9E-06	4.1E-10	2.7E-09
Toluene	4.2E-06	1.8E-05	7.6E-10	4.9E-09
Trichlorofluoromethane	1.8E-05	8.0E-05	3.3E-09	2.2E-08
Xylenes	1.6E-05	6.9E-05	2.8E-09	1.8E-08

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9-27).

Table O-2.2
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

Representative Wildlife Species		Percent Prey in Diet: Inverts	Plants	Small Mammals	Small Birds	Soil	Home Range (acres)	ED [f]	Site Foraging Frequency [g]	Food Ingestion Rate (kg/day)	Body Weight (kg)
White-footed mouse	(Herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0049	0.040
American robin	(Omn. bird)	33%	57%	0%	0%	10%	0.48	0.75	1.00E+00	0.011	0.077
Red fox	(Predatory mammal)	20%	10%	57%	10%	3%	1,727	1	2.90E-04	0.24	4.69
Barred owl	(Predatory bird)	3%	0%	80%	12%	5%	565	1	8.85E-04	0.047	0.72

NOTES:

SITE AREA:	0.5 acres

[e] Documentation of exposure parameters presented in: Appendix O-1, Table O-1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O−2.3
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA		ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS				BAF VALUES FOR OTHER FOOD ITEMS	
ANALYTE	RME CONCENTRATION (mg/kg)	Invert BAF [a]	Concentration in Invertebrate Tissue [b] (mg/kg)	Plant BAF [a]	Concentration in Plant Tissue [c] (mg/kg)	Small Mammal BAF [a]	Small Bird BAF [a]
Antimony	1.6E+00	5.0E−02	8.1E−02	4.0E−02	6.5E−02	5.0E−02	5.0E−02
Copper	3.9E+01	1.6E−01	6.3E+00	7.8E−01	3.1E+01	6.0E−01	6.0E−01
Lead	3.2E+02	7.8E−02	2.5E+01	9.0E−03	2.9E+00	1.5E−02	1.5E−02
Selenium	4.4E+00	7.6E−01	3.3E+00	9.0E−03	4.0E−02	7.5E−01	5.1E−01
4,4'−DDE	3.4E−02	3.3E+00	1.1E−01	1.0E−02	3.4E−04	1.2E+00	2.9E+00
Aroclor−1260	3.6E+00	5.8E+00	2.1E+01	1.2E−01	4.3E−01	3.8E+00	3.2E−01
Dieldrin	2.5E−02	5.5E+00	1.4E−01	1.7E−02	4.2E−04	1.5E+00	4.4E−01
Di−n−butylphthalate	7.7E−01	5.0E−02	3.9E−02	7.6E−03	5.9E−03	2.4E−01	2.4E−01
Fluoranthene	2.0E+00	5.0E−02	1.0E−01	4.9E−02	9.9E−02	1.5E−01	1.5E−01
Phenanthrene	1.0E+00	5.0E−02	5.0E−02	4.9E−02	4.9E−02	1.5E−01	1.5E−01
Pyrene	2.0E+00	5.0E−02	1.0E−01	4.9E−02	9.9E−02	1.5E−01	1.5E−01
Methylene chloride	8.1E−03	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	1.4E−03	NA	NA	NA	NA	NA	NA
Toluene	5.1E−03	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	7.2E−03	NA	NA	NA	NA	NA	NA
4,4'−DDD	1.0E−02	3.3E+00	3.3E−02	1.0E−02	1.0E−04	1.2E+00	2.9E+00
4,4'−DDT	1.8E−01	5.7E−01	1.0E−01	1.0E−02	1.8E−03	1.2E+00	2.9E+00
2−Methylnaphthylene	3.8E−01	5.0E−02	1.9E−02	2.5E−02	9.6E−03	1.5E−01	1.5E−01
Acenaphthylene	2.6E−01	5.0E−02	1.3E−02	2.5E−02	6.6E−03	1.5E−01	1.5E−01
Benzo(k)fluoranthene	6.0E−01	5.0E−02	3.0E−02	2.5E−02	1.5E−02	1.5E−01	1.5E−01
Chrysene	7.1E−01	5.0E−02	3.5E−02	2.5E−02	1.8E−02	1.5E−01	1.5E−01
Naphthalene	3.0E−01	5.0E−02	1.5E−02	2.5E−02	7.6E−03	1.5E−01	1.5E−01
1,2−Dichloroethylene (cis and trans)	6.9E−03	NA	0.0E+00	NA	0.0E+00	NA	NA
Acetone	6.7E−02	NA	0.0E+00	NA	0.0E+00	NA	NA
Ethylbenzene	5.9E−03	NA	0.0E+00	NA	0.0E+00	NA	NA
Arsenic	4.8E+01	6.6E−03	3.2E−01	3.0E−01	1.4E+01	1.0E−01	6.0E−03
Barium	1.1E+02	7.5E−03	7.9E−01	3.0E−02	3.2E+00	7.5E−03	7.5E−03
Manganese	2.7E+02	2.0E−02	5.5E+00	5.0E−02	1.4E+01	2.0E−02	2.0E−02
Zinc	1.5E+02	1.8E+00	2.7E+02	6.1E−01	9.2E+01	2.1E+00	2.1E+00

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O−1, Table O−1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–2.3
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	*White–footed mouse*	*American robin*	*Raccoon*	*Barred owl*	*Short–tailed shrew*
Antimony	1.2E–02	1.5E–02	8.1E–06	3.0E–06	1.0E–02
Copper	3.5E+00	1.6E+00	9.8E–04	3.7E–04	5.5E–01
Lead	1.4E+00	2.8E+00	1.4E–03	5.9E–04	2.3E+00
Selenium	5.6E–02	1.0E–01	4.2E–05	2.7E–05	1.3E–01
4,4'–DDE	1.5E–03	2.7E–03	1.0E–06	1.1E–06	4.0E–03
Aroclor–1260	3.1E–01	5.0E–01	2.6E–04	4.4E–04	7.4E–01
Dieldrin	1.8E–03	3.2E–03	1.2E–06	1.2E–06	4.8E–03
Di–n–butylphthalate	3.0E–03	6.2E–03	3.3E–06	1.6E–06	4.8E–03
Fluoranthene	1.7E–02	1.9E–02	1.1E–05	4.1E–06	1.3E–02
Phenanthrene	8.4E–03	9.7E–03	5.3E–06	2.1E–06	6.4E–03
Pyrene	1.7E–02	1.9E–02	1.1E–05	4.1E–06	1.3E–02
Methylene chloride	2.0E–05	5.4E–05	3.0E–08	1.4E–08	3.6E–05
Tetrachloroethylene	3.4E–06	9.4E–06	5.3E–09	2.4E–09	6.2E–06
Toluene	1.2E–05	3.4E–05	1.9E–08	8.8E–09	2.2E–05
Trichlorofluoromethane	1.8E–05	4.8E–05	2.7E–08	1.2E–08	3.2E–05
4,4'–DDD	4.4E–04	8.0E–04	3.0E–07	3.2E–07	1.2E–03
4,4'–DDT	1.9E–03	3.5E–03	1.6E–06	1.5E–06	4.3E–03
2–Methylnaphthylene	2.2E–03	3.3E–03	1.8E–06	7.7E–07	2.4E–03
Acenaphthylene	1.5E–03	2.3E–03	1.2E–06	5.2E–07	1.6E–03
Benzo(k)fluoranthene	3.5E–03	5.3E–03	2.8E–06	1.2E–06	3.8E–03
Chrysene	4.1E–03	6.2E–03	3.3E–06	1.4E–06	4.4E–03
Naphthalene	1.7E–03	2.6E–03	1.4E–06	6.0E–07	1.9E–03
1,2–Dichloroethylene (cis and trans)	1.7E–05	4.6E–05	2.6E–08	1.2E–08	3.0E–05
Acetone	1.6E–04	4.5E–04	2.5E–07	1.2E–07	3.0E–04
Ethylbenzene	1.4E–05	4.0E–05	2.2E–08	1.0E–08	2.6E–05
Arsenic	1.7E+00	8.8E–01	5.2E–04	1.1E–04	3.0E–01
Barium	6.1E–01	8.5E–01	4.8E–04	1.8E–04	5.1E–01
Manganese	2.2E+00	2.5E+00	1.4E–03	4.9E–04	1.5E+00
Zinc	1.4E+01	1.0E+01	6.0E–03	6.6E–03	1.0E+01

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O−2.3
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

Representative Wildlife Species		Percent Prey in Diet: Inverts	Plants	Small Mammals	Small Birds	Soil	Home Range (acres)	ED [f]	Site Foraging Frequency [g]	Food Ingestion Rate (kg/day)	Body Weight (kg)
White−footed mouse	(Herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0049	0.040
American robin	(Omn. bird)	33%	57%	0%	0%	10%	0.48	0.75	6.25E−01	0.011	0.077
Raccoon	(Predatory mammal)	14%	56%	19%	2%	9%	385	1	7.79E−04	0.214	3.99
Barred owl	(Predatory bird)	3%	0%	80%	12%	5%	565	1	5.31E−04	0.047	0.72
Short−tailed shrew	(Omn. mammal)	78%	12%	0%	0%	10%	0.96	1	3.12E−01	0.0024	0.017

NOTES:

SITE AREA:	0.3 acres

[e] Documentation of exposure parameters presented in: Appendix O−1, Table O−1.1
[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.
[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O−2.4

Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Concentrations of CPCs in Food and Surface Soil

Area 2 Floodplain

Remedial Investigation Report, AOC 57

Devens, Massachusetts

EXPOSURE CONCENTRATION DATA		ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS				BAF VALUES FOR OTHER FOOD ITEMS	
ANALYTE	Average CONCENTRATION (mg/kg)	Invert BAF [a]	Concentration in Invertebrate Tissue [b] (mg/kg)	Plant BAF [a]	Concentration in Plant Tissue [c] (mg/kg)	Small Mammal BAF [a]	Small Bird BAF [a]
Antimony	1.6E+00	5.0E−02	8.1E−02	4.0E−02	6.5E−02	5.0E−02	5.0E−02
Copper	1.6E+01	1.6E−01	2.5E+00	7.8E−01	1.2E+01	6.0E−01	6.0E−01
Lead	1.4E+02	7.8E−02	1.1E+01	9.0E−03	1.3E+00	1.5E−02	1.5E−02
Selenium	1.9E+00	7.6E−01	1.4E+00	9.0E−03	1.7E−02	7.5E−01	5.1E−01
4,4'−DDE	1.3E−02	3.3E+00	4.3E−02	1.0E−02	1.3E−04	1.2E+00	2.9E+00
Aroclor−1260	6.3E−01	5.8E+00	3.6E+00	1.2E−01	7.5E−02	3.8E+00	3.2E−01
Dieldrin	9.9E−03	5.5E+00	5.4E−02	1.7E−02	1.7E−04	1.5E+00	4.4E−01
Di−n−butylphthalate	3.3E−01	5.0E−02	1.6E−02	7.6E−03	2.5E−03	2.4E−01	2.4E−01
Fluoranthene	5.8E−01	5.0E−02	2.9E−02	4.9E−02	2.9E−02	1.5E−01	1.5E−01
Phenanthrene	3.9E−01	5.0E−02	1.9E−02	4.9E−02	1.9E−02	1.5E−01	1.5E−01
Pyrene	6.2E−01	5.0E−02	3.1E−02	4.9E−02	3.1E−02	1.5E−01	1.5E−01
Methylene Chloride	6.8E−03	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	9.0E−04	NA	NA	NA	NA	NA	NA
Toluene	1.7E−03	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	4.8E−03	NA	NA	NA	NA	NA	NA
4,4'−DDD	7.1E−03	3.3E+00	2.3E−02	1.0E−02	7.1E−05	1.2E+00	2.9E+00
4,4'−DDT	3.9E−02	5.7E−01	2.2E−02	1.0E−02	3.9E−04	1.2E+00	2.9E+00
2−Methylnaphthalene	1.8E−01	5.0E−02	8.8E−03	2.5E−02	4.5E−03	1.5E−01	1.5E−01
Acenaphthylene	1.3E−01	5.0E−02	6.5E−03	2.5E−02	3.3E−03	1.5E−01	1.5E−01
Benzo[k]fluoranthene	2.7E−01	5.0E−02	1.3E−02	2.5E−02	6.7E−03	1.5E−01	1.5E−01
Chrysene	3.9E−01	5.0E−02	1.9E−02	2.5E−02	9.8E−03	1.5E−01	1.5E−01
Naphthalene	1.4E−01	5.0E−02	7.2E−03	2.5E−02	3.6E−03	1.5E−01	1.5E−01
1,2−Dichloroethylene (cis and trans)	3.6E−03	NA	0.0E+00	NA	0.0E+00	NA	NA
Acetone	2.9E−02	NA	0.0E+00	NA	0.0E+00	NA	NA
Ethylbenzene	3.0E−03	NA	0.0E+00	NA	0.0E+00	NA	NA
Arsenic	2.4E+01	6.6E−03	1.6E−01	3.0E−01	7.2E+00	1.0E−01	6.0E−03
Barium	4.8E+01	7.5E−03	3.6E−01	3.0E−02	1.4E+00	7.5E−03	7.5E−03
Manganese	1.5E+02	2.0E−02	3.0E+00	5.0E−02	7.4E+00	2.0E−02	2.0E−02
Zinc	5.5E+01	1.8E+00	9.9E+01	6.1E−01	3.4E+01	2.1E+00	2.1E+00

CPC = Contaminant of Potential Concern

[a] Bioaccumulation data presented in: Appendix O−1, Table O−1.2

[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the average soil concentration of the CPC.

[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the average soil concentration of the CPC.

Table O-2.4
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	*White-footed mouse*	*American robin*	*Raccoon*	*Barred owl*	*Short-tailed shrew*
Antimony	1.2E-02	1.5E-02	8.1E-06	3.0E-06	1.0E-02
Copper	1.4E+00	6.3E-01	3.9E-04	1.5E-04	2.2E-01
Lead	6.3E-01	1.3E+00	6.3E-04	2.6E-04	1.0E+00
Selenium	2.4E-02	4.5E-02	1.8E-05	1.2E-05	5.8E-02
4,4'-DDE	5.8E-04	1.0E-03	4.0E-07	4.2E-07	1.5E-03
Aroclor-1260	5.4E-02	8.7E-02	4.6E-05	7.7E-05	1.3E-01
Dieldrin	7.1E-04	1.3E-03	4.8E-07	4.9E-07	1.9E-03
Di-n-butylphthalate	1.3E-03	2.7E-03	1.4E-06	6.9E-07	2.0E-03
Fluoranthene	4.9E-03	5.7E-03	3.1E-06	1.2E-06	3.7E-03
Phenanthrene	3.3E-03	3.8E-03	2.1E-06	8.0E-07	2.5E-03
Pyrene	5.2E-03	6.1E-03	3.3E-06	1.3E-06	4.0E-03
Methylene Chloride	1.7E-05	4.6E-05	2.6E-08	1.2E-08	3.0E-05
Tetrachloroethylene	2.2E-06	6.0E-06	3.4E-09	1.6E-09	4.0E-06
Toluene	4.2E-06	1.1E-05	6.4E-09	2.9E-09	7.5E-06
Trichlorofluoromethane	1.2E-05	3.2E-05	1.8E-08	8.3E-09	2.1E-05
4,4'-DDD	3.1E-04	5.7E-04	2.2E-07	2.3E-07	8.4E-04
4,4'-DDT	4.1E-04	7.6E-04	3.4E-07	3.2E-07	9.3E-04
2-Methylnaphthalene	1.0E-03	1.5E-03	8.3E-07	3.5E-07	1.1E-03
Acenaphthylene	7.5E-04	1.1E-03	6.1E-07	2.6E-07	8.1E-04
Benzo[k]fluoranthene	1.5E-03	2.3E-03	1.3E-06	5.4E-07	1.7E-03
Chrysene	2.2E-03	3.4E-03	1.8E-06	7.8E-07	2.4E-03
Naphthalene	8.3E-04	1.3E-03	6.8E-07	2.9E-07	9.0E-04
1,2-Dichloroethylene (cis and trans)	8.8E-06	2.4E-05	1.4E-08	6.2E-09	1.6E-05
Acetone	7.1E-05	1.9E-04	1.1E-07	5.0E-08	1.3E-04
Ethylbenzene	7.3E-06	2.0E-05	1.1E-08	5.2E-09	1.3E-05
Arsenic	8.4E-01	4.4E-01	2.6E-04	5.3E-05	1.5E-01
Barium	2.8E-01	3.8E-01	2.2E-04	8.4E-05	2.3E-01
Manganese	1.2E+00	1.3E+00	7.5E-04	2.7E-04	8.0E-01
Zinc	5.0E+00	3.8E+00	2.2E-03	2.4E-03	3.8E+00

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9-27).

Table O−2.4
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

Representative Wildlife Species		Percent Prey in Diet: Inverts	Plants	Small Mammals	Small Birds	Soil	Home Range (acres)	ED [f]	Site Foraging Frequency [g]	Food Ingestion Rate (kg/day)	Body Weight (kg)
White−footed mouse	(Herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0049	0.040
American robin	(Omn. bird)	33%	57%	0%	0%	10%	0.48	0.75	6.25E−01	0.011	0.077
Raccoon	(Predatory mammal)	14%	56%	19%	2%	9%	385	1	7.79E−04	0.214	3.99
Barred owl	(Predatory bird)	3%	0%	80%	12%	5%	565	1	5.31E−04	0.047	0.72
Short−tailed shrew	(Omn. mammal)	78%	12%	0%	0%	10%	0.96	1	3.12E−01	0.0024	0.017

NOTES:

SITE AREA:	0.3 acres

[e] Documentation of exposure parameters presented in: Appendix O−1, Table O−1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O–2.[illegible]

Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil

Area 3

Remedial Investigation Report, AOC 57

Devens, Massachusetts

EXPOSURE CONCENTRATION DATA		ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS				BAF VALUES FOR OTHER FOOD ITEMS	
ANALYTE	RME CONCENTRATION (mg/kg)	Invert BAF[a]	Concentration in Invertebrate Tissue[b] (mg/kg)	Plant BAF[a]	Concentration in Plant Tissue[c] (mg/kg)	Small Mammal BAF[a]	Small Bird BAF[a]
Arsenic	4.1E+01	6.6E–03	2.7E–01	3.0E–01	1.2E+01	1.0E–01	6.0E–03
Barium	Not a CPC	7.5E–03	0.0E+00	3.0E–02	0.0E+00	7.5E–03	7.5E–03
Cadmium	1.5E+00	1.4E+00	2.1E+00	3.3E+01	5.0E+01	2.1E+00	3.8E–01
Copper	Not a CPC	1.6E–01	0.0E+00	7.8E–01	0.0E+00	6.0E–01	6.0E–01
Lead	Not a CPC	7.8E–02	0.0E+00	9.0E–03	0.0E+00	1.5E–02	1.5E–02
Manganese	5.5E+02	2.0E–02	1.1E+01	5.0E–02	2.7E+01	2.0E–02	2.0E–02
Zinc	Not a CPC	1.8E+00	0.0E+00	6.1E–01	0.0E+00	2.1E+00	2.1E+00
4,4'–DDE	8.1E–03	1.7E+00	1.3E–02	1.0E–02	8.1E–05	1.2E+00	2.9E+00
4,4'–DDT	2.5E–02	5.7E–01	1.4E–02	1.0E–02	2.5E–04	1.2E+00	2.9E+00
Aroclor–1242	Not a CPC	5.8E+00	0.0E+00	1.2E–01	0.0E+00	3.8E+00	3.2E–01
Aroclor–1260	4.7E–01	5.8E+00	2.7E+00	1.2E–01	5.7E–02	3.8E+00	3.2E–01
Fluoranthene	1.4E–01	5.0E–02	7.0E–03	4.9E–02	6.9E–03	1.5E–01	1.5E–01
Naphthalene	4.8E–02	5.0E–02	2.4E–03	4.9E–02	2.4E–03	1.5E–01	1.5E–01
Phenanthrene	1.1E–01	5.0E–02	5.5E–03	4.9E–02	5.4E–03	1.5E–01	1.5E–01
Pyrene	1.5E–01	5.0E–02	7.5E–03	4.9E–02	7.4E–03	1.5E–01	1.5E–01
Tetrachloroethylene	Not a CPC	NA	NA	NA	NA	NA	NA
Toluene	3.0E–03	NA	NA	NA	NA	NA	NA
Selenium	1.6E+00	7.6E–01	1.2E+00	9.0E–03	1.4E–02	7.5E–01	5.1E–01
4,4'–DDD	2.7E–01	3.3E+00	8.9E–01	1.0E–02	2.7E–03	1.2E+00	2.9E+00
alpha–Chlordane	2.8E–03	1.6E+00	4.5E–03	5.1E–03	1.4E–05	5.5E–01	1.8E+00
gamma–Chlordane	2.8E–03	1.6E+00	4.5E–03	5.1E–03	1.4E–05	5.5E–01	1.8E+00
1,2–Dichlorobenzene	3.5E–01	5.0E–02	1.7E–02	7.3E–02	2.6E–02	1.5E–01	1.5E–01
1,4–Dichlorobenzene	4.8E–01	5.0E–02	2.4E–02	7.3E–02	3.5E–02	1.5E–01	1.5E–01
Bis(2–ethylhexyl)phthalate	Not a CPC	5.0E–02	0.0E+00	7.6E–03	0.0E+00	2.4E–01	2.4E–01
1,1,1–Trichloroethane	Not a CPC	NA	0.0E+00	NA	0.0E+00	NA	NA
Chlorobenzene	1.2E–02	NA	0.0E+00	NA	0.0E+00	NA	NA
Trichloroethylene	4.2E–03	NA	0.0E+00	NA	0.0E+00	NA	NA
Xylenes	Not a CPC	NA	0.0E+00	NA	0.0E+00	NA	NA

CPC = Contaminant of Potential Concern

[a] Bioaccumulation data presented in: Appendix O–1, Table O–1.2

[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.

[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–2.5
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	White–footed mouse	American robin	Red fox	Barred owl
Arsenic	1.4E+00	5.0E–01	1.9E–05	7.0E–05
Barium	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cadmium	5.4E+00	1.3E+00	3.4E–04	1.8E–03
Copper	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Lead	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Manganese	4.4E+00	3.3E+00	1.3E–04	6.6E–04
Zinc	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4,4'–DDE	1.9E–04	2.4E–04	2.7E–08	1.4E–07
4,4'–DDT	2.6E–04	3.3E–04	3.4E–08	2.1E–07
Aroclor–1242	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aroclor–1260	4.1E–02	4.4E–02	7.7E–06	2.8E–05
Fluoranthene	1.2E–03	9.0E–04	4.3E–08	2.1E–07
Naphthalene	4.0E–04	3.1E–04	1.5E–08	7.2E–08
Phenanthrene	9.2E–04	7.1E–04	3.4E–08	1.7E–07
Pyrene	1.3E–03	9.7E–04	4.6E–08	2.3E–07
Tetrachloroethylene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Toluene	7.3E–06	1.3E–05	5.3E–10	3.5E–09
Selenium	2.0E–02	2.5E–02	2.2E–06	6.7E–06
4,4'–DDD	1.2E–02	1.4E–02	1.7E–06	8.5E–06
alpha–Chlordane	6.4E–05	7.9E–05	7.4E–09	3.0E–08
gamma–Chlordane	6.4E–05	7.9E–05	7.4E–09	3.0E–08
1,2–Dichlorobenzene	3.8E–03	2.5E–03	1.2E–07	5.5E–07
1,4–Dichlorobenzene	5.3E–03	3.4E–03	1.6E–07	7.6E–07
Bis(2–ethylhexyl)phthalate	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1,1,1–Trichloroethane	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chlorobenzene	2.9E–05	5.4E–05	2.1E–09	1.4E–08
Trichloroethylene	1.0E–05	1.9E–05	7.5E–10	4.9E–09
Xylenes	0.0E+00	0.0E+00	0.0E+00	0.0E+00

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O-2.5
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

Representative Wildlife Species		Percent Prey in Diet: Inverts	Plants	Small Mammals	Small Birds	Soil	Home Range (acres)	ED [f]	Site Foraging Frequency [g]	Food Ingestion Rate (kg/day)	Body Weight (kg)
White-footed mouse	(Herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0049	0.040
American robin	(Omn. bird)	33%	57%	0%	0%	10%	0.48	0.75	4.17E-01	0.011	0.077
Red fox	(Predatory mammal)	20%	10%	57%	10%	3%	1,727	1	1.16E-04	0.24	4.69
Barred owl	(Predatory bird)	3%	0%	80%	12%	5%	565	1	3.54E-04	0.047	0.72

NOTES:

SITE AREA:	0.2 acres

[e] Documentation of exposure parameters presented in: Appendix O-1, Table O-1.1
[f] BD = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.
[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-2.6
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA		ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS				BAF VALUES FOR OTHER FOOD ITEMS	
ANALYTE	AVERAGE CONCENTRATION (mg/kg)	Invert BAF [a]	Concentration in Invertebrate Tissue [b] (mg/kg)	Plant BAF [a]	Concentration in Plant Tissue [c] (mg/kg)	Small Mammal BAF [a]	Small Bird BAF [a]
Arsenic	2.5E+01	6.6E-03	1.7E-01	3.0E-01	7.5E+00	1.0E-01	6.0E-03
Barium	Not a CPC	7.5E-03	0.0E+00	3.0E-02	0.0E+00	7.5E-03	7.5E-03
Cadmium	9.3E-01	1.4E+00	1.3E+00	3.3E+01	3.1E+01	2.1E+00	3.8E-01
Copper	Not a CPC	1.6E-01	0.0E+00	7.8E-01	0.0E+00	6.0E-01	6.0E-01
Lead	Not a CPC	7.8E-02	0.0E+00	9.0E-03	0.0E+00	1.5E-02	1.5E-02
Manganese	2.2E+00	2.0E-02	4.4E-02	5.0E-02	1.1E-01	2.0E-02	2.0E-02
Zinc	Not a CPC	1.8E+00	0.0E+00	6.1E-01	0.0E+00	2.1E+00	2.1E+00
4,4'-DDE	8.1E-03	1.7E+00	1.3E-02	1.0E-02	8.1E-05	1.2E+00	2.9E+00
4,4'-DDT	1.4E-02	5.7E-01	7.9E-03	1.0E-02	1.4E-04	1.2E+00	2.9E+00
Aroclor-1242	Not a CPC	5.8E+00	0.0E+00	1.2E-01	0.0E+00	3.8E+00	3.2E-01
Aroclor-1260	1.2E-01	5.8E+00	7.0E-01	1.2E-01	1.5E-02	3.8E+00	3.2E-01
Fluoranthene	1.4E-01	5.0E-02	7.0E-03	4.9E-02	6.9E-03	1.5E-01	1.5E-01
Naphthalene	4.8E-02	5.0E-02	2.4E-03	4.9E-02	2.4E-03	1.5E-01	1.5E-01
Phenanthrene	1.1E-01	5.0E-02	5.5E-03	4.9E-02	5.4E-03	1.5E-01	1.5E-01
Pyrene	1.5E-01	5.0E-02	7.5E-03	4.9E-02	7.4E-03	1.5E-01	1.5E-01
Tetrachloroethylene	Not a CPC	NA	NA	NA	NA	NA	NA
Toluene	1.4E-03	NA	NA	NA	NA	NA	NA
Selenium	4.8E-01	7.6E-01	3.6E-01	9.0E-03	4.3E-03	7.5E-01	5.1E-01
4,4'-DDD	6.1E-02	3.3E+00	2.0E-01	1.0E-02	6.1E-04	1.2E+00	2.9E+00
alpha-Chlordane	2.1E-03	1.6E+00	3.4E-03	5.1E-03	1.1E-05	5.5E-01	1.8E+00
gamma-Chlordane	2.1E-03	1.6E+00	3.4E-03	5.1E-03	1.1E-05	5.5E-01	1.8E+00
1,2-Dichlorobenzene	1.3E-01	5.0E-02	6.4E-03	7.3E-02	9.4E-03	1.5E-01	1.5E-01
1,4-Dichlorobenzene	1.6E-01	5.0E-02	7.8E-03	7.3E-02	1.1E-02	1.5E-01	1.5E-01
Chlorobenzene	3.3E-03	NA	NA	NA	NA	NA	NA
Trichloroethylene	2.1E-03	NA	NA	NA	NA	NA	NA

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the average exposure concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the average exposure concentration of the CPC.

Table O–2.6
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	*White–footed mouse*	*American robin*	*Red fox*	*Barred owl*
Arsenic	8.7E–01	3.0E–01	1.1E–05	4.2E–05
Barium	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Cadmium	3.3E+00	8.0E–01	2.1E–04	1.1E–03
Copper	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Lead	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Manganese	1.8E–02	1.3E–02	5.2E–07	2.6E–06
Zinc	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4,4'–DDE	1.9E–04	2.4E–04	2.7E–08	1.4E–07
4,4'–DDT	1.5E–04	1.8E–04	1.9E–08	1.2E–07
Aroclor–1242	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aroclor–1260	1.0E–02	1.1E–02	2.0E–06	7.1E–06
Fluoranthene	1.2E–03	9.0E–04	4.3E–08	2.1E–07
Naphthalene	4.0E–04	3.1E–04	1.5E–08	7.2E–08
Phenanthrene	9.2E–04	7.1E–04	3.4E–08	1.7E–07
Pyrene	1.3E–03	9.7E–04	4.6E–08	2.3E–07
Tetrachloroethylene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Toluene	3.4E–06	6.3E–06	2.5E–10	1.6E–09
Selenium	6.1E–03	7.6E–03	6.6E–07	2.0E–06
4,4'–DDD	2.7E–03	3.3E–03	3.8E–07	1.9E–06
alpha–Chlordane	4.7E–05	5.9E–05	5.5E–09	2.2E–08
gamma–Chlordane	4.7E–05	5.9E–05	5.5E–09	2.2E–08
1,2–Dichlorobenzene	1.4E–03	9.1E–04	4.2E–08	2.0E–07
1,4–Dichlorobenzene	1.7E–03	1.1E–03	5.2E–08	2.5E–07
Chlorobenzene	8.1E–06	1.5E–05	5.9E–10	3.8E–09
Trichloroethylene	5.1E–06	9.4E–06	3.7E–10	2.4E–09

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O−2.6
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

Representative Wildlife Species		Percent Prey in Diet: Inverts	Plants	Small Mammals	Small Birds	Soil	Home Range (acres)	ED [f]	Site Foraging Frequency [g]	Food Ingestion Rate (kg/day)	Body Weight (kg)
White−footed mouse	(Herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0049	0.040
American robin	(Omn. bird)	33%	57%	0%	0%	10%	0.48	0.75	4.17E−01	0.011	0.077
Red fox	(Predatory mammal)	20%	10%	57%	10%	3%	1,727	1	1.16E−04	0.24	4.69
Barred owl	(Predatory bird)	3%	0%	80%	12%	5%	565	1	3.54E−04	0.047	0.72

NOTES:

SITE AREA:	0.2 acres

[e] Documentation of exposure parameters presented in: Appendix O−1, Table O−1.1
[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.
[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-2.7
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA / **ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

CHEMICAL	RME SEDIMENT CONCENTRATION (mg/kg)	RME UNFILT. SURFACE WATER CONCENTRATION (mg/L)	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)	Tissue Exposure (mg/kg)
Aluminum	1.6E+04	1.5E+01	<300	7.5E-02	1.2E+03	6.0E-03	1.2E+03	1.2E+03
Arsenic	2.2E+02	2.0E-01	<300	6.6E-03	1.5E+00	3.0E-01	1.5E+00	1.5E+00
Barium	1.6E+02	5.5E-01	<300	7.5E-03	1.2E+00	2.5E-02	1.2E+00	1.2E+00
Cadmium	Not a CP	2.5E-02	3.2E+02	NA	7.8E+00	NA	7.8E+00	7.8E+00
Chromium	4.9E+01	3.6E-02	<300	1.6E-01	7.8E+00	6.3E-03	7.8E+00	7.8E+00
Cobalt	2.6E+01	Not a CPC	NA	1.0E+00	2.6E+01	9.3E-03	2.6E+01	2.6E+01
Copper	2.0E+02	3.7E-01	3.4E+02	1.6E-01	1.3E+02	6.0E-02	1.3E+02	1.3E+02
Lead	4.1E+02	9.7E-01	<300	7.8E-02	3.2E+01	5.6E-02	3.2E+01	3.2E+01
Manganese	3.9E+03	4.3E-01	1.7E+03	2.0E-02	7.2E+02	1.3E-01	7.2E+02	7.2E+02
Mercury	3.6E-01	2.4E-04	6.3E+04	1.7E+01	1.5E+01	2.4E-01	1.5E+01	1.5E+01
Nickel	4.3E+01	Not a CPC	NA	2.3E-01	9.9E+00	1.4E-02	9.9E+00	9.9E+00
Selenium	7.7E+00	2.4E-03	<300	7.6E-01	5.9E+00	1.6E-01	5.9E+00	5.9E+00
Vanadium	Not a CP	7.2E-02	<300	NA	0.0E+00	NA	0.0E+00	0.0E+00
Zinc	4.7E+02	7.1E-01	<300	1.8E+00	8.4E+02	9.2E-01	8.4E+02	8.4E+02
4,4'-DDD	4.4E-01	Not a CPC	NA	NA	NA	1.0E-02	0.0E+00 [b]	5.5E-02 [b]
4,4'-DDE	1.6E-01	Not a CPC	NA	NA	NA	1.0E-02	4.1E-03 [b]	5.3E-02 [b]
4,4'-DDT	7.6E-02	Not a CPC	NA	2.1E+00	1.6E-01	1.0E-02	1.6E-01	1.6E-01
Aroclor-1260	3.0E-01	Not a CPC	NA	NA	NA	1.2E-01	7.3E-02 [b]	1.5E-01 [b]
Dieldrin	4.6E-02	Not a CPC	NA	NA	NA	1.7E-02	0.0E+00 [b]	2.2E-03 [b]
Benzo[k]fluoranthene	3.0E+00	Not a CPC	NA	5.0E-02	1.5E-01	4.9E-02	1.5E-01	1.5E-01
Bis(2-ethylhexyl)phthalate	Not a CP	2.4E-02	3.1E+02	5.0E-02	7.4E+00	7.6E-03	7.4E+00	7.4E+00
Fluoranthene	6.0E+00	Not a CPC	NA	5.0E-02	3.0E-01	4.9E-02	3.0E-01	3.0E-01
Phenanthrene	3.0E+00	5.2E-04	3.2E+02	5.0E-02	1.7E-01	4.9E-02	1.7E-01	1.7E-01
Pyrene	6.0E+00	Not a CPC	NA	5.0E-02	3.0E-01	4.9E-02	3.0E-01	3.0E-01
1,2-Dichloroethylenes (cis and trans)	Not a CP	2.6E-02	NA	NA	NA	NA	NA	NA
Acetone	3.1E-01	Not a CPC	NA	NA	NA	NA	NA	NA
Methylene chloride	1.5E-01	4.1E-03	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	7.8E-02	1.8E-03	NA	NA	NA	NA	NA	NA
Toluene	2.0E-02	1.1E-03	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	7.6E-02	Not a CPC	NA	NA	NA	NA	NA	NA

Table O–2.7
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA

CHEMICAL	RME SEDIMENT CONCENTRATION (mg/kg)	RME UNFILT. SURFACE WATER CONCENTRATION (mg/L)
1,2–Dichlorobenzene	Not a CP	Not a CPC
1,4–Dichlorobenzene	Not a CP	Not a CPC
Benzo(b)fluoranthene	Not a CP	Not a CPC
Chrysene	1.2E+00	Not a CPC
Naphthalene	Not a CP	Not a CPC
Benzene	Not a CP	Not a CPC
Carbon disulfide	Not a CP	1.1E–03
Chlorobenzene	Not a CP	Not a CPC
Chloroform	Not a CP	7.2E–04
Trichloroethylene	2.7E–02	3.5E–03
Xylene	Not a CP	Not a CPC

ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS

CHEMICAL	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)	Tissue Exposure (mg/kg)
1,2–Dichlorobenzene	NA	5.0E–02	0.0E+00	7.3E–02	0.0E+00	0.0E+00
1,4–Dichlorobenzene	NA	5.0E–02	0.0E+00	7.3E–02	0.0E+00	0.0E+00
Benzo(b)fluoranthene	NA	5.0E–02	0.0E+00	2.5E–02	0.0E+00	0.0E+00
Chrysene	NA	5.0E–02	6.0E–02	2.5E–02	6.0E–02	6.0E–02
Naphthalene	NA	5.0E–02	0.0E+00	2.5E–02	0.0E+00	0.0E+00
Benzene	NA	NA	0.0E+00	NA	NA	NA
Carbon disulfide	NA	NA	0.0E+00	NA	NA	NA
Chlorobenzene	NA	NA	0.0E+00	NA	NA	NA
Chloroform	NA	NA	0.0E+00	NA	NA	NA
Trichloroethylene	NA	NA	0.0E+00	NA	NA	NA
Xylene	NA	NA	0.0E+00	NA	NA	NA

[a] Bioaccumulation data presented in: Appendix O, Tables O–1.2 and O–1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.

[b] Measured crayfish and fish tissue concentrations (provided in Table O–1.3).

Table O-2.7
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]

CHEMICAL	*Muskrat*	*Mallard*	*Raccoon*	*Great blue heron*
Aluminum	1.2E+02	7.2E-02	2.5E-01	6.3E+01
Arsenic	5.0E+00	1.1E-02	2.1E-03	2.5E-01
Barium	1.3E+00	1.3E-03	1.6E-03	1.9E-01
Cadmium	5.4E-02	1.7E-05	7.0E-04	3.2E-01
Chromium	3.9E-01	2.3E-04	1.1E-03	3.6E-01
Cobalt	3.5E-01	1.7E-04	2.5E-03	1.1E+00
Copper	2.8E+00	2.9E-03	1.3E-02	5.4E+00
Lead	4.2E+00	5.3E-03	6.6E-03	1.7E+00
Manganese	5.8E+01	9.7E-02	9.9E-02	3.3E+01
Mercury	1.1E-01	4.0E-05	1.4E-03	6.3E-01
Nickel	3.8E-01	2.5E-04	1.3E-03	4.4E-01
Selenium	1.6E-01	2.3E-04	5.9E-04	2.5E-01
Vanadium	6.8E-03	1.2E-05	1.1E-05	7.6E-04
Zinc	3.2E+01	7.2E-02	7.9E-02	3.5E+01
4,4'-DDD	3.1E-03	2.2E-06	3.9E-06	2.6E-03
4,4'-DDE	1.2E-03	8.0E-07	1.8E-06	2.3E-03
4,4'-DDT	1.6E-03	6.4E-07	1.5E-05	6.6E-03
Aroclor-1260	3.9E-03	6.8E-06	9.1E-06	6.6E-03
Dieldrin	3.5E-04	2.8E-07	4.0E-07	1.3E-04
Benzo[k]fluoranthene	2.9E-02	3.4E-05	4.0E-05	8.7E-03
Bis(2-ethylhexyl)phthalate	5.1E-02	1.6E-05	6.6E-04	3.1E-01
Fluoranthene	5.7E-02	6.8E-05	7.9E-05	1.7E-02
Phenanthrene	2.9E-02	3.4E-05	4.1E-05	9.5E-03
Pyrene	5.7E-02	6.8E-05	7.9E-05	1.7E-02
1,2-Dichloroethylenes (cis and trans)	2.5E-03	4.4E-06	4.1E-06	2.7E-04
Acetone	2.1E-03	1.0E-06	2.7E-06	2.6E-04
Methylene chloride	1.4E-03	1.2E-06	2.0E-06	1.7E-04
Tetrachloroethylene	6.9E-04	5.6E-07	9.7E-07	8.4E-05
Toluene	2.4E-04	2.5E-07	3.5E-07	2.8E-05
Trichlorofluoromethane	5.0E-04	2.5E-07	6.7E-07	6.4E-05

Table O–2.7
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]

CHEMICAL	*Muskrat*	*Mallard*	*Raccoon*	*Great blue heron*
1,2–Dichlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1,4–Dichlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(b)fluoranthene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chrysene	9.9E–03	4.1E–06	1.6E–05	3.5E–03
Naphthalene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	1.0E–04	1.8E–07	1.7E–07	1.2E–05
Chlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chloroform	6.8E–05	1.2E–07	1.1E–07	7.6E–06
Trichloroethylene	5.1E–04	6.8E–07	7.9E–07	6.0E–05
Xylene	0.0E+00	0.0E+00	0.0E+00	0.0E+00

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9–27).

Table O–2.?
Exposure Parameters and Assumptions for Semi–Aquatic Receptors
Area 2

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EXPOSURE PARAMETERS [d]

Indicator Species		Percent Prey in Diet: Aquatic Organisms	Percent Prey in Diet: Plants	Sediment	Home Range (acres)	ED [e]	Site Foraging Frequency [f]	Dietary Ingestion Rate (kg/day)	Water Ingestion Rate (L/day)	Body Weight (kg)
Muskrat	(Small herb. mammal)	10%	80%	10%	0.2	1	1.00E+00	0.084	0.12	1.27
Mallard	(Small herb. bird)	1%	97%	2%	235	1	2.98E–03	0.063	0.064	1.134
Raccoon	(Predatory mammal)	91%	0%	9%	385	1	1.82E–03	0.214	0.344	3.99
Great blue heron	(Piscivorous bird)	98%	0%	2%	1.5	0.5	4.67E–01	0.401	0.101	2.23

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O–1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

SITE AREA:	0.7 acres

Table O–2.8
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
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EXPOSURE CONCENTRATION DATA			ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS					
CHEMICAL	AVERAGE SEDIMENT CONCENTRATION (mg/kg)	AVERAGE UNFILT. SURFACE WATER CONCENTRATION (mg/L)	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)	Heron Tissue Exposure (mg/kg)
Aluminum	1.2E+04	2.6E+00	<300	7.5E−02	8.7E+02	6.0E−03	8.7E+02	8.7E+02
Arsenic	7.0E+01	5.1E−02	<300	6.6E−03	4.6E−01	3.0E−01	4.6E−01	4.6E−01
Barium	7.0E+01	1.6E−01	<300	7.5E−03	5.2E−01	2.5E−02	5.2E−01	5.2E−01
Cadmium	Not a CP	5.8E−03	3.2E+02	NA	1.8E+00	NA	1.8E+00	1.8E+00
Chromium	2.3E+01	8.5E−03	<300	1.6E−01	3.7E+00	6.3E−03	3.7E+00	3.7E+00
Cobalt	1.5E+01	Not a CPC	NA	1.0E+00	1.5E+01	9.3E−03	1.5E+01	1.5E+01
Copper	4.7E+01	7.5E−02	3.4E+02	1.6E−01	2.5E+01	6.0E−02	2.5E+01	2.5E+01
Lead	1.7E+02	2.4E−01	<300	7.8E−02	1.4E+01	5.6E−02	1.4E+01	1.4E+01
Manganese	1.2E+03	2.4E−01	1.7E+03	2.0E−02	4.0E+02	1.3E−01	4.0E+02	4.0E+02
Mercury	8.1E−02	1.4E−04	6.3E+04	1.7E+01	8.9E+00	2.4E−01	8.9E+00	8.9E+00
Nickel	2.9E+01	Not a CPC	NA	2.3E−01	6.7E+00	1.4E−02	6.7E+00	6.7E+00
Selenium	2.3E+00	1.5E−03	<300	7.6E−01	1.7E+00	1.6E−01	1.7E+00	1.7E+00
Vanadium	Not a CP	1.7E−02	<300	NA	0.0E+00	NA	0.0E+00	0.0E+00
Zinc	2.1E+02	1.8E−01	<300	1.8E+00	3.7E+02	9.2E−01	3.7E+02	3.7E+02
4,4'−DDD	1.5E−01	Not a CPC	NA	NA	NA	1.0E−02	0.0E+00 [b]	5.5E−02 [b]
4,4'−DDE	5.6E−02	Not a CPC	NA	NA	NA	1.0E−02	4.1E−03 [b]	5.3E−02 [b]
4,4'−DDT	4.0E−02	Not a CPC	NA	2.1E+00	8.4E−02	1.0E−02	8.4E−02	8.4E−02
Aroclor−1260	6.9E−02	Not a CPC	NA	NA	NA	1.2E−01	7.3E−02 [b]	1.5E−01 [b]
Dieldrin	9.6E−03	Not a CPC	NA	NA	NA	1.7E−02	0.0E+00 [b]	2.2E−03 [b]
Benzo[k]fluoranthene	5.8E−01	Not a CPC	NA	5.0E−02	2.9E−02	4.9E−02	2.9E−02	2.9E−02
Bis(2−ethylhexyl)phthalate	Not a CP	4.8E−03	3.1E+02	5.0E−02	1.5E+00	7.6E−03	1.5E+00	1.5E+00
Fluoranthene	2.2E+00	Not a CPC	NA	5.0E−02	1.1E−01	4.9E−02	1.1E−01	1.1E−01
Phenanthrene	8.0E−01	2.8E−04	3.2E+02	5.0E−02	9.1E−02	4.9E−02	9.1E−02	9.1E−02
Pyrene	2.3E+00	Not a CPC	NA	5.0E−02	1.1E−01	4.9E−02	1.1E−01	1.1E−01
1,2−Dichloroethylenes (cis and trans)	Not a CP	3.1E−03	NA	NA	NA	NA	NA	NA
Acetone	8.0E−02	Not a CPC	NA	NA	NA	NA	NA	NA
Methylene chloride	2.2E−02	1.8E−03	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	1.0E−02	1.1E−03	NA	NA	NA	NA	NA	NA
Toluene	5.0E−03	3.4E−04	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	1.3E−02	Not a CPC	NA	NA	NA	NA	NA	NA

Table O–2.8
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

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EXPOSURE CONCENTRATION DATA			ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS					
CHEMICAL	AVERAGE SEDIMENT CONCENTRATION (mg/kg)	AVERAGE UNFILT. SURFACE WATER CONCENTRATION (mg/L)	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)	Heron Tissue Exposure (mg/kg)
1,2–Dichlorobenzene	Not a CP	Not a CPC	NA	5.0E–02	0.0E+00	7.3E–02	0.0E+00	0.0E+00
1,4–Dichlorobenzene	Not a CP	Not a CPC	NA	5.0E–02	0.0E+00	7.3E–02	0.0E+00	0.0E+00
Benzo(b)fluoranthene	Not a CP	Not a CPC	NA	5.0E–02	0.0E+00	2.5E–02	0.0E+00	0.0E+00
Chrysene	4.7E–01	Not a CPC	NA	5.0E–02	2.4E–02	2.5E–02	2.4E–02	2.4E–02
Naphthalene	Not a CP	Not a CPC	NA	5.0E–02	0.0E+00	2.5E–02	0.0E+00	0.0E+00
Benzene	Not a CP	Not a CPC	NA	NA	0.0E+00	NA	NA	NA
Carbon disulfide	Not a CP	3.4E–04	NA	NA	0.0E+00	NA	NA	NA
Chlorobenzene	Not a CP	Not a CPC	NA	NA	0.0E+00	NA	NA	NA
Chloroform	Not a CP	3.0E–04	NA	NA	0.0E+00	NA	NA	NA
Trichloroethylene	4.2E–03	6.5E–04	NA	NA	0.0E+00	NA	NA	NA
Xylene	Not a CP	Not a CPC	NA	NA	0.0E+00	NA	NA	NA

[a] Bioaccumulation data presented in: Appendix O, Tables O–1.2 and O–1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.
[b] Measured crayfish and fish tissue concentrations (provided in Table O–1.3).

Table O-2.8
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

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POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]

CHEMICAL	Muskrat	Mallard	Raccoon	Great blue heron
Aluminum	8.6E+01	5.1E-02	1.8E-01	4.6E+01
Arsenic	1.6E+00	3.6E-03	6.7E-04	7.9E-02
Barium	5.7E-01	5.4E-04	6.8E-04	8.2E-02
Cadmium	1.3E-02	4.0E-06	1.6E-04	7.6E-02
Chromium	1.9E-01	1.1E-04	5.3E-04	1.7E-01
Cobalt	2.1E-01	9.7E-05	1.5E-03	6.3E-01
Copper	6.3E-01	6.6E-04	2.7E-03	1.1E+00
Lead	1.8E+00	2.2E-03	2.8E-03	7.1E-01
Manganese	1.9E+01	3.0E-02	4.6E-02	1.8E+01
Mercury	6.1E-02	1.8E-05	7.9E-04	3.7E-01
Nickel	2.6E-01	1.7E-04	8.5E-04	3.0E-01
Selenium	4.6E-02	7.0E-05	1.8E-04	7.4E-02
Vanadium	1.6E-03	2.8E-06	2.6E-06	1.8E-04
Zinc	1.4E+01	3.2E-02	3.5E-02	1.5E+01
4,4'-DDD	1.1E-03	7.2E-07	1.3E-06	2.4E-03
4,4'-DDE	4.0E-04	2.8E-07	8.6E-07	2.2E-03
4,4'-DDT	8.4E-04	3.3E-07	7.8E-06	3.5E-03
Aroclor-1260	9.0E-04	1.6E-06	7.1E-06	6.4E-03
Dieldrin	7.2E-05	5.8E-08	8.4E-08	9.7E-05
Benzo[k]fluoranthene	5.5E-03	6.6E-06	7.7E-06	1.7E-03
Bis(2-ethylhexyl)phthalate	1.0E-02	3.3E-06	1.3E-04	6.1E-02
Fluoranthene	2.1E-02	2.5E-05	2.9E-05	6.3E-03
Phenanthrene	8.0E-03	9.2E-06	1.5E-05	4.4E-03
Pyrene	2.2E-02	2.6E-05	3.0E-05	6.6E-03
1,2-Dichloroethylenes (cis and trans)	2.9E-04	5.2E-07	4.9E-07	3.3E-05
Acetone	5.3E-04	2.7E-07	7.1E-07	6.7E-05
Methylene chloride	3.1E-04	3.7E-07	4.7E-07	3.7E-05
Tetrachloroethylene	1.7E-04	2.2E-07	2.6E-07	2.0E-05
Toluene	6.6E-05	7.4E-08	9.8E-08	7.8E-06
Trichlorofluoromethane	8.6E-05	4.3E-08	1.1E-07	1.1E-05

Table O-2.8
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

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POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]

CHEMICAL	*Muskrat*	*Mallard*	*Raccoon*	*Great blue heron*
1,2-Dichlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1,4-Dichlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(b)fluoranthene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chrysene	3.9E-03	1.6E-06	6.2E-06	1.4E-03
Naphthalene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	3.3E-05	5.8E-08	5.4E-08	3.6E-06
Chlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chloroform	2.9E-05	5.1E-08	4.7E-08	3.2E-06
Trichloroethylene	8.9E-05	1.2E-07	1.4E-07	1.0E-05
Xylene	0.0E+00	0.0E+00	0.0E+00	0.0E+00

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9-27).

Table O-2.8
Exposure Parameters and Assumptions for Semi-Aquatic Receptors
Area 2

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EXPOSURE PARAMETERS [d]

Indicator Species		Percent Prey in Diet: Aquatic Organisms	Percent Prey in Diet: Plants	Sediment	Home Range (acres)	ED [e]	Site Foraging Frequency [f]	Dietary Ingestion Rate (kg/day)	Water Ingestion Rate (L/day)	Body Weight (kg)
Muskrat	(Small herb. mammal)	10%	80%	10%	0.2	1	1.00E+00	0.084	0.12	1.27
Mallard	(Herb. bird)	1%	97%	2%	235	1	2.98E-03	0.063	0.064	1.134
Raccoon	(Predatory mammal)	91%	0%	9%	385	1	1.82E-03	0.214	0.344	3.99
Great blue heron	(Piscivorous bird)	98%	0%	2%	1.5	0.5	4.67E-01	0.401	0.101	2.23

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O-1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

SITE AREA:	0.7 acres

Table O-2.9
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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EXPOSURE CONCENTRATION DATA			ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS					
CHEMICAL	RME SEDIMENT CONCENTRATION (mg/kg)	RME FILTERED SURFACE WATER CONCENTRATION (mg/L)	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)	Heron Tissue Exposure (mg/kg)
Aluminum	1.6E+04	Not a CPC	NA	7.5E-02	1.2E+03	6.0E-03	1.2E+03	1.2E+03
Arsenic	2.2E+02	8.9E-03	<300	6.6E-03	1.5E+00	3.0E-01	1.5E+00	1.5E+00
Barium	1.6E+02	4.3E-02	<300	7.5E-03	1.2E+00	2.5E-02	1.2E+00	1.2E+00
Cadmium	Not a CPC	Not a CPC	NA	NA	0.0E+00	NA	0.0E+00	0.0E+00
Chromium	4.9E+01	Not a CPC	NA	1.6E-01	7.8E+00	6.3E-03	7.8E+00	7.8E+00
Cobalt	2.6E+01	Not a CPC	NA	1.0E+00	2.6E+01	9.3E-03	2.6E+01	2.6E+01
Copper	2.0E+02	Not a CPC	NA	1.6E-01	3.2E+01	6.0E-02	3.2E+01	3.2E+01
Lead	4.1E+02	2.3E-03	<300	7.8E-02	3.2E+01	5.6E-02	3.2E+01	3.2E+01
Manganese	3.9E+03	4.8E-01	1.7E+03	2.0E-02	8.0E+02	1.3E-01	8.0E+02	8.0E+02
Mercury	3.6E-01	Not a CPC	NA	1.7E+01	6.1E+00	2.4E-01	6.1E+00	6.1E+00
Nickel	4.3E+01	Not a CPC	NA	2.3E-01	9.9E+00	1.4E-02	9.9E+00	9.9E+00
Selenium	7.7E+00	Not a CPC	NA	7.6E-01	5.9E+00	1.6E-01	5.9E+00	5.9E+00
Vanadium	Not a CPC	Not a CPC	NA	NA	0.0E+00	NA	0.0E+00	0.0E+00
Zinc	4.7E+02	5.8E-02	<300	1.8E+00	8.4E+02	9.2E-01	8.4E+02	8.4E+02
4,4'-DDD	4.4E-01	Not a CPC	NA	NA	NA	1.0E-02	0.0E+00 [b]	5.5E-02 [b]
4,4'-DDE	1.6E-01	Not a CPC	NA	NA	NA	1.0E-02	4.1E-03 [b]	5.3E-02 [b]
4,4'-DDT	7.6E-02	Not a CPC	NA	2.1E+00	1.6E-01	1.0E-02	1.6E-01	1.6E-01
Aroclor-1260	3.0E-01	Not a CPC	NA	NA	NA	1.2E-01	7.3E-02 [b]	1.5E-01 [b]
Dieldrin	4.6E-02	Not a CPC	NA	NA	NA	1.7E-02	0.0E+00 [b]	2.2E-03 [b]
Benzo[k]fluoranthene	3.0E+00	Not a CPC	NA	5.0E-02	1.5E-01	4.9E-02	1.5E-01	1.5E-01
Bis(2-ethylhexyl)phthalate	Not a CPC	2.4E-02	3.1E+02	5.0E-02	7.4E+00	7.6E-03	7.4E+00	7.4E+00
Fluoranthene	6.0E+00	Not a CPC	NA	5.0E-02	3.0E-01	4.9E-02	3.0E-01	3.0E-01
Phenanthrene	3.0E+00	5.2E-04	3.2E+02	5.0E-02	1.7E-01	4.9E-02	1.7E-01	1.7E-01
Pyrene	6.0E+00	Not a CPC	NA	5.0E-02	3.0E-01	4.9E-02	3.0E-01	3.0E-01
1,2-Dichloroethylenes (cis an	Not a CPC	2.6E-02	NA	NA	NA	NA	NA	NA
Acetone	3.1E-01	Not a CPC	NA	NA	NA	NA	NA	NA
Methylene chloride	1.5E-01	4.1E-03	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	7.8E-02	1.8E-03	NA	NA	NA	NA	NA	NA
Toluene	2.0E-02	1.1E-03	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	7.6E-02	Not a CPC	NA	NA	NA	NA	NA	NA

Table O–2.9
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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EXPOSURE CONCENTRATION DATA

CHEMICAL	RME SEDIMENT CONCENTRATION (mg/kg)	RME FILTERED SURFACE WATER CONCENTRATION (mg/L)
1,2–Dichlorobenzene	Not a CP(	Not a CPC
1,4–Dichlorobenzene	Not a CP(	Not a CPC
Benzo(b)fluoranthene	Not a CP(	Not a CPC
Chrysene	1.2E+00	Not a CPC
Naphthalene	Not a CP(	Not a CPC
Benzene	Not a CP(	Not a CPC
Carbon disulfide	Not a CP(	1.1E–03
Chlorobenzene	Not a CP(	Not a CPC
Chloroform	Not a CP(	7.2E–04
Trichloroethylene	2.7E–02	3.5E–03
Xylene	Not a CP(	Not a CPC

ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS

CHEMICAL	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	**Raccoon Tissue Exposure (mg/kg)**	**Heron Tissue Exposure (mg/kg)**
1,2–Dichlorobenzene	NA	5.0E–02	0.0E+00	7.3E–02	0.0E+00	0.0E+00
1,4–Dichlorobenzene	NA	5.0E–02	0.0E+00	7.3E–02	0.0E+00	0.0E+00
Benzo(b)fluoranthene	NA	5.0E–02	0.0E+00	2.5E–02	0.0E+00	0.0E+00
Chrysene	NA	5.0E–02	6.0E–02	2.5E–02	6.0E–02	6.0E–02
Naphthalene	NA	5.0E–02	0.0E+00	2.5E–02	0.0E+00	0.0E+00
Benzene	NA	NA	0.0E+00	NA	NA	NA
Carbon disulfide	NA	NA	0.0E+00	NA	NA	NA
Chlorobenzene	NA	NA	0.0E+00	NA	NA	NA
Chloroform	NA	NA	0.0E+00	NA	NA	NA
Trichloroethylene	NA	NA	0.0E+00	NA	NA	NA
Xylene	NA	NA	0.0E+00	NA	NA	NA

[a] Bioaccumulation data presented in: Appendix O, Tables O–1.2 and O–1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.
[b] Measured crayfish and fish tissue concentrations (provided in Table O–1.3).

Table O-2.9
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]

CHEMICAL	Muskrat	Mallard	Raccoon	Great blue heron
Aluminum	1.2E+02	7.0E-02	2.5E-01	6.2E+01
Arsenic	5.0E+00	1.1E-02	2.1E-03	2.4E-01
Barium	1.3E+00	1.2E-03	1.5E-03	1.8E-01
Cadmium	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chromium	3.9E-01	2.2E-04	1.1E-03	3.6E-01
Cobalt	3.5E-01	1.7E-04	2.5E-03	1.1E+00
Copper	2.2E+00	2.7E-03	4.6E-03	1.5E+00
Lead	4.1E+00	5.1E-03	6.4E-03	1.7E+00
Manganese	5.9E+01	9.7E-02	1.1E-01	3.6E+01
Mercury	4.7E-02	2.5E-05	5.5E-04	2.5E-01
Nickel	3.8E-01	2.5E-04	1.3E-03	4.4E-01
Selenium	1.5E-01	2.3E-04	5.9E-04	2.5E-01
Vanadium	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Zinc	3.1E+01	7.2E-02	7.9E-02	3.5E+01
4,4'-DDD	3.1E-03	2.2E-06	3.9E-06	2.6E-03
4,4'-DDE	1.2E-03	8.0E-07	1.8E-06	2.3E-03
4,4'-DDT	1.6E-03	6.4E-07	1.5E-05	6.6E-03
Aroclor-1260	3.9E-03	6.8E-06	9.1E-06	6.6E-03
Dieldrin	3.5E-04	2.8E-07	4.0E-07	1.3E-04
Benzo[k]fluoranthene	2.9E-02	3.4E-05	4.0E-05	8.7E-03
Bis(2-ethylhexyl)phthalate	5.1E-02	1.6E-05	6.6E-04	3.1E-01
Fluoranthene	5.7E-02	6.8E-05	7.9E-05	1.7E-02
Phenanthrene	2.9E-02	3.4E-05	4.1E-05	9.5E-03
Pyrene	5.7E-02	6.8E-05	7.9E-05	1.7E-02
1,2-Dichloroethylenes (cis an	2.5E-03	4.4E-06	4.1E-06	2.7E-04
Acetone	2.1E-03	1.0E-06	2.7E-06	2.6E-04
Methylene chloride	1.4E-03	1.2E-06	2.0E-06	1.7E-04
Tetrachloroethylene	6.9E-04	5.6E-07	9.7E-07	8.4E-05
Toluene	2.4E-04	2.5E-07	3.5E-07	2.8E-05
Trichlorofluoromethane	5.0E-04	2.5E-07	6.7E-07	6.4E-05

Table O–2.9
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]

CHEMICAL	*Muskrat*	*Mallard*	*Raccoon*	*Great blue heron*
1,2–Dichlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1,4–Dichlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(b)fluoranthene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chrysene	9.9E–03	4.1E–06	1.6E–05	3.5E–03
Naphthalene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	1.0E–04	1.8E–07	1.7E–07	1.2E–05
Chlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chloroform	6.8E–05	1.2E–07	1.1E–07	7.6E–06
Trichloroethylene	5.1E–04	6.8E–07	7.9E–07	6.0E–05
Xylene	0.0E+00	0.0E+00	0.0E+00	0.0E+00

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9–27).

Table O–2.9
Exposure Parameters and Assumptions for Semi–Aquatic Receptors
Area 2

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EXPOSURE PARAMETERS [d]

Indicator Species		Percent Prey in Diet: Aquatic Organisms	Percent Prey in Diet: Plants	Percent Prey in Diet: Sediment	Home Range (acres)	ED [e]	Site Foraging Frequency [f]	Dietary Ingestion Rate (kg/day)	Water Ingestion Rate (L/day)	Body Weight (kg)
Muskrat	(Small herb. mammal)	10%	80%	10%	0.2	1	1.00E+00	0.084	0.12	1.27
Mallard	(Herb. bird)	1%	97%	2%	235	1	2.98E–03	0.063	0.064	1.134
Raccoon	(Predatory mammal)	91%	0%	9%	385	1	1.82E–03	0.214	0.344	3.99
Great blue heron	(Piscivorous bird)	98%	0%	2%	1.5	0.5	4.67E–01	0.401	0.101	2.23

NOTES:

[d] Documentation of exposure parameters presented in: Appendix O, Table O–1.1

[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)

[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

SITE AREA:	0.7	acres

Table O-2.10
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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EXPOSURE CONCENTRATION DATA / **ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

CHEMICAL	AVERAGE SEDIMENT CONCENTRATION (mg/kg)	AVERAGE FILT. SURFACE WATER CONCENTRATION (mg/L)	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)	Heron Tissue Exposure (mg/kg)
Aluminum	1.2E+04	Not a CPC	NA	7.5E-02	8.7E+02	6.0E-03	8.7E+02	8.7E+02
Arsenic	7.0E+01	4.4E-03	<300	6.6E-03	4.6E-01	3.0E-01	4.6E-01	4.6E-01
Barium	7.0E+01	2.2E-02	<300	7.5E-03	5.2E-01	2.5E-02	5.2E-01	5.2E-01
Cadmium	Not a CP	Not a CPC	NA	NA	0.0E+00	NA	0.0E+00	0.0E+00
Chromium	2.3E+01	Not a CPC	NA	1.6E-01	3.7E+00	6.3E-03	3.7E+00	3.7E+00
Cobalt	1.5E+01	Not a CPC	NA	1.0E+00	1.5E+01	9.3E-03	1.5E+01	1.5E+01
Copper	4.7E+01	Not a CPC	NA	1.6E-01	7.5E+00	6.0E-02	7.5E+00	7.5E+00
Lead	1.7E+02	5.8E-03	<300	7.8E-02	1.4E+01	5.6E-02	1.4E+01	1.4E+01
Manganese	1.2E+03	2.0E-01	1.7E+03	2.0E-02	3.3E+02	1.3E-01	3.3E+02	3.3E+02
Mercury	8.1E-02	Not a CPC	NA	1.7E+01	1.4E+00	2.4E-01	1.4E+00	1.4E+00
Nickel	2.9E+01	Not a CPC	NA	2.3E-01	6.7E+00	1.4E-02	6.7E+00	6.7E+00
Selenium	2.3E+00	Not a CPC	NA	7.6E-01	1.7E+00	1.6E-01	1.7E+00	1.7E+00
Vanadium	Not a CP	Not a CPC	NA	NA	0.0E+00	NA	0.0E+00	0.0E+00
Zinc	2.1E+02	2.2E-02	<300	1.8E+00	3.7E+02	9.2E-01	3.7E+02	3.7E+02
4,4'-DDD	1.5E-01	Not a CPC	NA	NA	NA	1.0E-02	0.0E+00 [b]	5.5E-02 [b]
4,4'-DDE	5.6E-02	Not a CPC	NA	NA	NA	1.0E-02	4.1E-03 [b]	5.3E-02 [b]
4,4'-DDT	4.0E-02	Not a CPC	NA	2.1E+00	8.4E-02	1.0E-02	8.4E-02	8.4E-02
Aroclor-1260	6.9E-02	Not a CPC	NA	NA	NA	1.2E-01	7.3E-02 [b]	1.5E-01 [b]
Dieldrin	9.6E-03	Not a CPC	NA	NA	NA	1.7E-02	0.0E+00 [b]	2.2E-03 [b]
Benzo[k]fluoranthene	5.8E-01	Not a CPC	NA	5.0E-02	2.9E-02	4.9E-02	2.9E-02	2.9E-02
Bis(2-ethylhexyl)phthalate	Not a CP	4.8E-03	3.1E+02	5.0E-02	1.5E+00	7.6E-03	1.5E+00	1.5E+00
Fluoranthene	2.2E+00	Not a CPC	NA	5.0E-02	1.1E-01	4.9E-02	1.1E-01	1.1E-01
Phenanthrene	8.0E-01	2.8E-04	3.2E+02	5.0E-02	9.1E-02	4.9E-02	9.1E-02	9.1E-02
Pyrene	2.3E+00	Not a CPC	NA	5.0E-02	1.1E-01	4.9E-02	1.1E-01	1.1E-01
1,2-Dichloroethylenes (cis and trans)	Not a CP	3.1E-03	NA	NA	NA	NA	NA	NA
Acetone	8.0E-02	Not a CPC	NA	NA	NA	NA	NA	NA
Methylene chloride	2.2E-02	1.8E-03	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	1.0E-02	1.1E-03	NA	NA	NA	NA	NA	NA
Toluene	5.0E-03	3.4E-04	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	1.3E-02	Not a CPC	NA	NA	NA	NA	NA	NA

Table O–2.10
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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EXPOSURE CONCENTRATION DATA

ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS

CHEMICAL	AVERAGE SEDIMENT CONCENTRATION (mg/kg)	AVERAGE FILT. SURFACE WATER CONCENTRATION (mg/L)	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)	Heron Tissue Exposure (mg/kg)
1,2–Dichlorobenzene	Not a CP	Not a CPC	NA	5.0E–02	0.0E+00	7.3E–02	0.0E+00	0.0E+00
1,4–Dichlorobenzene	Not a CP	Not a CPC	NA	5.0E–02	0.0E+00	7.3E–02	0.0E+00	0.0E+00
Benzo(b)fluoranthene	Not a CP	Not a CPC	NA	5.0E–02	0.0E+00	2.5E–02	0.0E+00	0.0E+00
Chrysene	4.7E–01	Not a CPC	NA	5.0E–02	2.4E–02	2.5E–02	2.4E–02	2.4E–02
Naphthalene	Not a CP	Not a CPC	NA	5.0E–02	0.0E+00	2.5E–02	0.0E+00	0.0E+00
Benzene	Not a CP	Not a CPC	NA	NA	0.0E+00	NA	NA	NA
Carbon disulfide	Not a CP	3.4E–04	NA	NA	0.0E+00	NA	NA	NA
Chlorobenzene	Not a CP	Not a CPC	NA	NA	0.0E+00	NA	NA	NA
Chloroform	Not a CP	3.0E–04	NA	NA	0.0E+00	NA	NA	NA
Trichloroethylene	4.2E–03	6.5E–04	NA	NA	0.0E+00	NA	NA	NA
Xylene	Not a CP	Not a CPC	NA	NA	0.0E+00	NA	NA	NA

[a] Bioaccumulation data presented in: Appendix O, Tables O–1.2 and O–1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.
[b] Measured crayfish and fish tissue concentrations (provided in Table O–1.3).

Table O-2.10
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]

CHEMICAL	*Muskrat*	*Mallard*	*Raccoon*	*Great blue heron*
Aluminum	8.6E+01	5.1E-02	1.8E-01	4.6E+01
Arsenic	1.6E+00	3.6E-03	6.6E-04	7.8E-02
Barium	5.6E-01	5.2E-04	6.6E-04	8.0E-02
Cadmium	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chromium	1.9E-01	1.1E-04	5.3E-04	1.7E-01
Cobalt	2.1E-01	9.7E-05	1.5E-03	6.3E-01
Copper	5.1E-01	6.2E-04	1.1E-03	3.5E-01
Lead	1.8E+00	2.2E-03	2.7E-03	7.1E-01
Manganese	1.8E+01	3.0E-02	4.0E-02	1.4E+01
Mercury	1.1E-02	5.7E-06	1.2E-04	5.7E-02
Nickel	2.6E-01	1.7E-04	8.5E-04	3.0E-01
Selenium	4.6E-02	7.0E-05	1.8E-04	7.4E-02
Vanadium	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Zinc	1.4E+01	3.2E-02	3.5E-02	1.5E+01
4,4'-DDD	1.1E-03	7.2E-07	1.3E-06	2.4E-03
4,4'-DDE	4.0E-04	2.8E-07	8.6E-07	2.2E-03
4,4'-DDT	8.4E-04	3.3E-07	7.8E-06	3.5E-03
Aroclor-1260	9.0E-04	1.6E-06	7.1E-06	6.4E-03
Dieldrin	7.2E-05	5.8E-08	8.4E-08	9.7E-05
Benzo[k]fluoranthene	5.5E-03	6.6E-06	7.7E-06	1.7E-03
Bis(2-ethylhexyl)phthalate	1.0E-02	3.3E-06	1.3E-04	6.1E-02
Fluoranthene	2.1E-02	2.5E-05	2.9E-05	6.3E-03
Phenanthrene	8.0E-03	9.2E-06	1.5E-05	4.4E-03
Pyrene	2.2E-02	2.6E-05	3.0E-05	6.6E-03
1,2-Dichloroethylenes (cis and trans)	2.9E-04	5.2E-07	4.9E-07	3.3E-05
Acetone	5.3E-04	2.7E-07	7.1E-07	6.7E-05
Methylene chloride	3.1E-04	3.7E-07	4.7E-07	3.7E-05
Tetrachloroethylene	1.7E-04	2.2E-07	2.6E-07	2.0E-05
Toluene	6.6E-05	7.4E-08	9.8E-08	7.8E-06
Trichlorofluoromethane	8.6E-05	4.3E-08	1.1E-07	1.1E-05

Table O−2.10
Estimated Chronic Exposure to Semi−Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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POTENTIAL DIETARY EXPOSURE (mg/kgBW−day) [c]

CHEMICAL	*Muskrat*	*Mallard*	*Raccoon*	*Great blue heron*
1,2−Dichlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1,4−Dichlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(b)fluoranthene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chrysene	3.9E−03	1.6E−06	6.2E−06	1.4E−03
Naphthalene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	3.3E−05	5.8E−08	5.4E−08	3.6E−06
Chlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Chloroform	2.9E−05	5.1E−08	4.7E−08	3.2E−06
Trichloroethylene	8.9E−05	1.2E−07	1.4E−07	1.0E−05
Xylene	0.0E+00	0.0E+00	0.0E+00	0.0E+00

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9−27).

Table O-2.10
Exposure Parameters and Assumptions for Semi-Aquatic Receptors
Area 2

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EXPOSURE PARAMETERS [d]

Indicator Species		Percent Prey in Diet: Aquatic Organisms	Percent Prey in Diet: Plants	Sediment	Home Range (acres)	ED [e]	Site Foraging Frequency [f]	Dietary Ingestion Rate (kg/day)	Water Ingestion Rate (L/day)	Body Weight (kg)
Muskrat	(Small herb. mammal)	10%	80%	10%	0.2	1	1.00E+00	0.084	0.12	1.27
Mallard	(Herb. bird)	1%	97%	2%	235	1	2.98E-03	0.063	0.064	1.134
Raccoon	(Predatory mammal)	91%	0%	9%	385	1	1.82E-03	0.214	0.344	3.99
Great blue heron	(Piscivorous bird)	98%	0%	2%	1.5	0.5	4.67E-01	0.401	0.101	2.23

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O-1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

SITE AREA:	0.7 acres

Table O-2.11
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 3

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EXPOSURE CONCENTRATION DATA			ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS				
CHEMICAL	RME SEDIMENT CONCENTRATION (mg/kg)	RME UNFILT. SURFACE WATER CONCENTRATION (mg/L)	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)
Arsenic	Not a CP	1.5E-01	<300	6.6E-03	0.0E+00	3.0E-01	0.0E+00
Barium	Not a CP	2.8E-01	<300	7.5E-03	0.0E+00	2.5E-02	0.0E+00
Copper	Not a CP	4.4E-02	3.4E+02	1.6E-01	1.5E+01	6.0E-02	1.5E+01
Lead	Not a CP	1.8E-01	<300	7.8E-02	0.0E+00	5.6E-02	0.0E+00
Selenium	Not a CP	2.5E-03	<300	7.6E-01	0.0E+00	1.6E-01	0.0E+00
Zinc	Not a CP	4.5E-01	<300	1.8E+00	0.0E+00	9.2E-01	0.0E+00
4,4'-DDD	1.5E-01	Not a CPC	NA	NA	NA	1.0E-02	0.0E+00 [b]
Aroclor-1260	8.4E-01	Not a CPC	NA	NA	NA	1.2E-01	7.3E-02 [b]
Benzo[k]fluoranthene	2.8E-01	9.4E-04	NA	5.0E-02	1.4E-02	4.9E-02	1.4E-02
Fluoranthene	6.5E-01	Not a CPC	NA	5.0E-02	3.3E-02	4.9E-02	3.3E-02
Phenanthrene	3.7E-01	Not a CPC	3.2E+02	5.0E-02	1.8E-02	4.9E-02	1.8E-02
Pyrene	5.6E-01	Not a CPC	NA	5.0E-02	2.8E-02	4.9E-02	2.8E-02
Acetone	2.1E-01	Not a CPC	NA	NA	NA	NA	NA
Toluene	4.8E-03	1.6E-03	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	3.9E-01	Not a CPC	NA	5.0E-02	2.0E-02	7.3E-02	2.0E-02
1,4-Dichlorobenzene	1.0E+00	Not a CPC	NA	5.0E-02	5.0E-02	7.3E-02	5.0E-02
Benzo(b)fluoranthene	4.9E-01	Not a CPC	NA	5.0E-02	2.5E-02	2.5E-02	2.5E-02
Chrysene	3.4E-01	Not a CPC	NA	5.0E-02	1.7E-02	2.5E-02	1.7E-02
Naphthalene	5.3E-01	Not a CPC	NA	5.0E-02	2.7E-02	2.5E-02	2.7E-02
Benzene	3.7E-02	Not a CPC	NA	NA	0.0E+00	NA	NA
Carbon disulfide	Not a CP	5.8E-04	NA	NA	0.0E+00	NA	NA
Chlorobenzene	1.9E-02	4.6E-03	NA	NA	0.0E+00	NA	NA
Xylene	1.1E-02	Not a CPC	NA	NA	0.0E+00	NA	NA
Antimony	Not a CP	5.6E-03	<300	NA	0.0E+00	4.0E-02	0.0E+00

[a] Bioaccumulation data presented in: Appendix O, Tables O-1.2 and O-1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.
[b] Measured crayfish and fish tissue concentrations (provided in Table O-1.3).

Table O–2.11
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]

CHEMICAL	*Raccoon*
Arsenic	6.9E–06
Barium	1.2E–05
Copper	3.8E–04
Lead	8.2E–06
Selenium	1.1E–07
Zinc	2.0E–05
4,4'–DDD	3.8E–07
Aroclor–1260	4.0E–06
Benzo[k]fluoranthene	1.1E–06
Fluoranthene	2.5E–06
Phenanthrene	1.4E–06
Pyrene	2.1E–06
Acetone	5.3E–07
Toluene	8.4E–08
1,2–Dichlorobenzene	1.5E–06
1,4–Dichlorobenzene	3.8E–06
Benzo(b)fluoranthene	1.8E–06
Chrysene	1.3E–06
Naphthalene	2.0E–06
Benzene	9.3E–08
Carbon disulfide	2.6E–08
Chlorobenzene	2.5E–07
Xylene	2.8E–08
Antimony	2.5E–07

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9–27).

Table O-2.11
Exposure Parameters and Assumptions for Semi-Aquatic Receptors
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE PARAMETERS [d]

Indicator Species		Percent Prey in Diet: Aquatic Organisms	Percent Prey in Diet: Plants	Percent Prey in Diet: Sediment	Home Range (acres)	ED [e]	Site Foraging Frequency [f]	Dietary Ingestion Rate (kg/day)	Water Ingestion Rate (L/day)	Body Weight (kg)
Raccoon	(Predatory mammal)	91%	0%	9%	385	1	5.19E-04	0.214	0.344	3.99

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O-1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

SITE AREA:	0.2 acres

Table O–2.12
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	White–footed mouse			American robin			Red fox		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Arsenic	7.3E–01	5.8E–01	1.3E+00	6.1E–01	1.0E+00	6.1E–01	2.4E–05	5.8E–01	4.2E–05
Cobalt	1.1E–01	4.2E+00	2.7E–02	3.5E–01	4.2E+00	8.3E–02	3.7E–05	4.2E+00	8.8E–06
Copper	1.4E+00	1.0E+02	1.4E–02	1.0E+00	1.0E+02	1.0E–02	9.6E–05	1.0E+02	9.6E–07
Manganese	3.9E+00	4.5E+01	8.6E–02	7.0E+00	4.5E+01	1.5E–01	2.8E–04	4.5E+01	6.3E–06
Nickel	2.0E–01	1.3E+01	1.5E–02	6.0E–01	5.0E+01	1.2E–02	4.1E–05	1.3E+01	3.2E–06
Selenium	1.1E–02	2.0E–01	5.6E–02	3.4E–02	6.0E–01	5.6E–02	3.1E–06	2.0E–01	1.6E–05
4,4'–DDE	4.8E–04	2.0E–01	2.4E–03	1.4E–03	3.9E–01	3.6E–03	1.9E–07	1.2E+01	1.6E–08
4,4'–DDT	2.7E–04	2.0E–01	1.4E–03	8.2E–04	1.4E–01	5.8E–03	1.0E–07	1.2E+01	8.6E–09
2–Methylnaphthalene	3.6E–03	1.0E+01	3.6E–04	6.7E–03	1.0E+01	6.7E–04	3.3E–07	1.0E+01	3.3E–08
Bis(2–ethylhexyl)phthalate	1.0E–02	3.5E+01	3.0E–04	3.5E–02	3.5E+01	1.0E–03	1.9E–06	3.5E+01	5.4E–08
Dibenzofuran	1.1E–03	1.3E+01	8.5E–05	2.3E–03	1.3E+01	1.9E–04	1.2E–07	1.3E+01	9.4E–09
Fluoranthene	2.5E–03	1.0E+01	2.5E–04	4.6E–03	1.0E+01	4.6E–04	2.3E–07	1.0E+01	2.3E–08
Naphthalene	3.5E–03	3.6E+01	9.9E–05	6.5E–03	3.6E+01	1.8E–04	3.3E–07	3.6E+01	9.1E–09
Phenanthrene	2.3E–03	1.0E+01	2.3E–04	4.3E–03	1.0E+01	4.3E–04	2.2E–07	1.0E+01	2.2E–08
Pyrene	3.3E–03	1.0E+01	3.3E–04	6.2E–03	1.0E+01	6.2E–04	3.1E–07	1.0E+01	3.1E–08
Chloroform	2.2E–06	1.6E+02	1.3E–08	9.5E–06	1.6E+02	5.8E–08	4.0E–10	1.6E+02	2.4E–12
Ethylbenzene	5.9E–06	2.9E+02	2.0E–08	2.6E–05	2.9E+02	8.8E–08	1.1E–09	2.9E+02	3.7E–12
Tetrachloroethylene	7.3E–06	1.0E+02	7.4E–08	3.2E–05	1.0E+02	3.2E–07	1.3E–09	1.0E+02	1.3E–11
Toluene	9.1E–06	7.6E+01	1.2E–07	4.0E–05	7.6E+01	5.2E–07	1.6E–09	7.6E+01	2.2E–11
Trichlorofluoromethane	4.2E–05	3.5E+01	1.2E–06	1.8E–04	3.5E+01	5.2E–06	7.6E–09	3.5E+01	2.2E–10
Xylenes	7.1E–05	5.0E+02	1.4E–07	3.1E–04	5.0E+02	6.2E–07	1.3E–08	5.0E+02	2.6E–11
SUMMARY HAZARD INDEX			1.5E+00			9.4E–01			7.7E–05

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-2.12
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	*Barred owl*		
	PDE	RTV	HQ
Arsenic	9.0E-05	1.0E+00	9.0E-05
Cobalt	1.9E-04	4.2E+00	4.5E-05
Copper	5.6E-04	1.0E+02	5.6E-06
Manganese	1.5E-03	4.5E+01	3.3E-05
Nickel	1.8E-04	5.0E+01	3.6E-06
Selenium	1.2E-05	6.0E-01	2.1E-05
4,4'-DDE	1.6E-06	3.9E-01	4.2E-06
4,4'-DDT	9.9E-07	1.4E-01	7.1E-06
2-Methylnaphthalene	1.8E-06	1.0E+01	1.8E-07
Bis(2-ethylhexyl)phthalate	1.2E-05	3.5E+01	3.3E-07
Dibenzofuran	6.5E-07	1.3E+01	5.2E-08
Fluoranthene	1.3E-06	1.0E+01	1.3E-07
Naphthalene	1.8E-06	3.6E+01	4.9E-08
Phenanthrene	1.2E-06	1.0E+01	1.2E-07
Pyrene	1.7E-06	1.0E+01	1.7E-07
Chloroform	2.6E-09	1.6E+02	1.6E-11
Ethylbenzene	6.9E-09	2.9E+02	2.4E-11
Tetrachloroethylene	8.7E-09	1.0E+02	8.7E-11
Toluene	1.1E-08	7.6E+01	1.4E-10
Trichlorofluoromethane	4.9E-08	3.5E+01	1.4E-09
Xylenes	8.4E-08	5.0E+02	1.7E-10
SUMMARY HAZARD INDEX			2.1E-04

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O−2.13
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	*White−footed mouse*			*American robin*			*Red fox*		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Arsenic	5.1E−01	5.8E−01	8.7E−01	4.2E−01	1.0E+00	4.2E−01	1.7E−05	5.8E−01	2.9E−05
Cobalt	7.0E−02	4.2E+00	1.7E−02	2.1E−01	4.2E+00	5.1E−02	2.3E−05	4.2E+00	5.4E−06
Copper	9.7E−01	1.0E+02	9.7E−03	7.0E−01	1.0E+02	7.0E−03	6.7E−05	1.0E+02	6.7E−07
Manganese	2.3E+00	4.5E+01	5.1E−02	4.1E+00	4.5E+01	9.1E−02	1.7E−04	4.5E+01	3.7E−06
Nickel	1.1E−01	1.3E+01	8.5E−03	3.3E−01	5.0E+01	6.6E−03	2.3E−05	1.3E+01	1.7E−06
Selenium	3.6E−03	2.0E−01	1.8E−02	1.1E−02	6.0E−01	1.8E−02	1.0E−06	2.0E−01	5.0E−06
4,4'−DDE	1.7E−04	2.0E−01	8.4E−04	4.9E−04	3.9E−01	1.3E−03	6.6E−08	1.2E+01	5.5E−09
4,4'−DDT	8.4E−05	2.0E−01	4.2E−04	2.5E−04	1.4E−01	1.8E−03	3.2E−08	1.2E+01	2.6E−09
2−Methylnaphthalene	1.7E−03	1.0E+01	1.7E−04	3.1E−03	1.0E+01	3.1E−04	1.6E−07	1.0E+01	1.6E−08
Bis(2−ethylhexyl)phthalate	6.2E−03	3.5E+01	1.8E−04	2.1E−02	3.5E+01	5.9E−04	1.1E−06	3.5E+01	3.2E−08
Dibenzofuran	5.5E−04	1.3E+01	4.4E−05	1.2E−03	1.3E+01	9.6E−05	6.1E−08	1.3E+01	4.9E−09
Fluoranthene	1.3E−03	1.0E+01	1.3E−04	2.5E−03	1.0E+01	2.5E−04	1.2E−07	1.0E+01	1.2E−08
Naphthalene	1.8E−03	3.6E+01	4.9E−05	3.3E−03	3.6E+01	9.1E−05	1.6E−07	3.6E+01	4.6E−09
Phenanthrene	1.3E−03	1.0E+01	1.3E−04	2.3E−03	1.0E+01	2.3E−04	1.2E−07	1.0E+01	1.2E−08
Pyrene	1.5E−03	1.0E+01	1.5E−04	2.8E−03	1.0E+01	2.8E−04	1.4E−07	1.0E+01	1.4E−08
Chloroform	1.3E−06	1.6E+02	7.9E−09	5.7E−06	1.6E+02	3.5E−08	2.4E−10	1.6E+02	1.4E−12
Ethylbenzene	2.9E−06	2.9E+02	1.0E−08	1.3E−05	2.9E+02	4.4E−08	5.3E−10	2.9E+02	1.8E−12
Tetrachloroethylene	2.3E−06	1.0E+02	2.3E−08	9.9E−06	1.0E+02	9.9E−08	4.1E−10	1.0E+02	4.1E−12
Toluene	4.2E−06	7.6E+01	5.5E−08	1.8E−05	7.6E+01	2.4E−07	7.6E−10	7.6E+01	9.9E−12
Trichlorofluoromethane	1.8E−05	3.5E+01	5.2E−07	8.0E−05	3.5E+01	2.3E−06	3.3E−09	3.5E+01	9.5E−11
Xylenes	1.6E−05	5.0E+02	3.1E−08	6.9E−05	5.0E+02	1.4E−07	2.8E−09	5.0E+02	5.7E−12
SUMMARY HAZARD INDEX			9.8E−01			6.0E−01			4.5E−05

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.13
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	Barred owl		
	PDE	RTV	HQ
Arsenic	6.2E–05	1.0E+00	6.2E–05
Cobalt	1.2E–04	4.2E+00	2.8E–05
Copper	3.9E–04	1.0E+02	3.9E–06
Manganese	8.7E–04	4.5E+01	1.9E–05
Nickel	1.0E–04	5.0E+01	2.0E–06
Selenium	3.9E–06	6.0E–01	6.6E–06
4,4'–DDE	5.8E–07	3.9E–01	1.5E–06
4,4'–DDT	3.1E–07	1.4E–01	2.2E–06
2–Methylnaphthalene	8.4E–07	1.0E+01	8.4E–08
Bis(2–ethylhexyl)phthalate	6.9E–06	3.5E+01	2.0E–07
Dibenzofuran	3.4E–07	1.3E+01	2.7E–08
Fluoranthene	6.7E–07	1.0E+01	6.7E–08
Naphthalene	8.8E–07	3.6E+01	2.5E–08
Phenanthrene	6.3E–07	1.0E+01	6.3E–08
Pyrene	7.6E–07	1.0E+01	7.6E–08
Chloroform	1.5E–09	1.6E+02	9.3E–12
Ethylbenzene	3.5E–09	2.9E+02	1.2E–11
Tetrachloroethylene	2.7E–09	1.0E+02	2.7E–11
Toluene	4.9E–09	7.6E+01	6.5E–11
Trichlorofluoromethane	2.2E–08	3.5E+01	6.2E–10
Xylenes	1.8E–08	5.0E+02	3.7E–11
SUMMARY HAZARD INDEX			1.3E–04

PDE = Potential Dietary Exposure (mg/kgBW/day)   RTV = Reference Toxicity Value (mg/kgBW/day)   HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-2.14
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	White-footed mouse			American robin			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Antimony	1.2E-02	4.2E+01	2.9E-04	1.5E-02	4.2E+01	3.6E-04	8.1E-06	4.2E+01	1.9E-07
Copper	3.5E+00	1.0E+02	3.5E-02	1.6E+00	1.0E+02	1.6E-02	9.8E-04	1.0E+02	9.8E-06
Lead	1.4E+00	2.5E+00	5.6E-01	2.8E+00	7.5E+01	3.7E-02	1.4E-03	2.5E+00	5.7E-04
Selenium	5.6E-02	2.0E-01	2.8E-01	1.0E-01	6.0E-01	1.7E-01	4.2E-05	2.0E-01	2.1E-04
4,4'-DDE	1.5E-03	2.0E-01	7.5E-03	2.7E-03	3.9E-01	7.0E-03	1.0E-06	1.2E+01	8.6E-08
Aroclor-1260	3.1E-01	6.4E+00	4.9E-02	5.0E-01	9.0E-01	5.6E-01	2.6E-04	7.5E-03	3.5E-02
Dieldrin	1.8E-03	6.5E-01	2.8E-03	3.2E-03	6.0E-01	5.4E-03	1.2E-06	6.5E-01	1.9E-06
Di-n-butylphthalate	3.0E-03	1.1E+00	2.7E-03	6.2E-03	1.1E+00	5.7E-03	3.3E-06	1.1E+00	3.0E-06
Fluoranthene	1.7E-02	1.0E+01	1.7E-03	1.9E-02	1.0E+01	1.9E-03	1.1E-05	1.0E+01	1.1E-06
Phenanthrene	8.4E-03	1.0E+01	8.4E-04	9.7E-03	1.0E+01	9.7E-04	5.3E-06	1.0E+01	5.3E-07
Pyrene	1.7E-02	1.0E+01	1.7E-03	1.9E-02	1.0E+01	1.9E-03	1.1E-05	1.0E+01	1.1E-06
Methylene chloride	2.0E-05	5.3E+01	3.8E-07	5.4E-05	5.3E+01	1.0E-06	3.0E-08	5.3E+01	5.8E-10
Tetrachloroethylene	3.4E-06	1.0E+02	3.4E-08	9.4E-06	1.0E+02	9.4E-08	5.3E-09	1.0E+02	5.3E-11
Toluene	1.2E-05	7.6E+01	1.6E-07	3.4E-05	7.6E+01	4.5E-07	1.9E-08	7.6E+01	2.5E-10
Trichlorofluoromethane	1.8E-05	3.5E+01	5.0E-07	4.8E-05	3.5E+01	1.4E-06	2.7E-08	3.5E+01	7.7E-10
4,4'-DDD	4.4E-04	2.0E-01	2.2E-03	8.0E-04	1.4E-01	5.7E-03	3.0E-07	1.2E+01	2.5E-08
4,4'-DDT	1.9E-03	2.0E-01	9.5E-03	3.5E-03	1.4E-01	2.5E-02	1.6E-06	1.2E+01	1.3E-07
2-Methylnaphthylene	2.2E-03	1.0E+01	2.2E-04	3.3E-03	1.0E+01	3.3E-04	1.8E-06	1.0E+01	1.8E-07
Acenaphthylene	1.5E-03	1.0E+01	1.5E-04	2.3E-03	1.0E+01	2.3E-04	1.2E-06	1.0E+01	1.2E-07
Benzo(k)fluoranthene	3.5E-03	1.0E+01	3.5E-04	5.3E-03	1.0E+01	5.3E-04	2.8E-06	1.0E+01	2.8E-07
Chrysene	4.1E-03	1.0E+01	4.1E-04	6.2E-03	1.0E+01	6.2E-04	3.3E-06	1.0E+01	3.3E-07
Naphthalene	1.7E-03	3.6E+01	4.9E-05	2.6E-03	3.6E+01	7.4E-05	1.4E-06	3.6E+01	4.0E-08
1,2-Dichloroethylene (cis and trans)	1.7E-05	3.0E+01	5.6E-07	4.6E-05	3.0E+01	1.5E-06	2.6E-08	3.0E+01	8.7E-10
Acetone	1.6E-04	6.0E+02	2.7E-07	4.5E-04	6.0E+02	7.5E-07	2.5E-07	6.0E+02	4.2E-10
Ethylbenzene	1.4E-05	2.9E+02	5.0E-08	4.0E-05	2.9E+02	1.4E-07	2.2E-08	2.9E+02	7.6E-11
Arsenic	1.7E+00	5.8E-01	2.9E+00	8.8E-01	1.0E+00	8.8E-01	5.2E-04	5.8E-01	9.0E-04
Barium	6.1E-01	2.0E+02	3.1E-03	8.5E-01	2.0E+02	4.3E-03	4.8E-04	2.0E+02	2.4E-06
Manganese	2.2E+00	4.5E+01	4.9E-02	2.5E+00	4.5E+01	5.5E-02	1.4E-03	4.5E+01	3.1E-05
Zinc	1.4E+01	2.0E+02	6.8E-02	1.0E+01	2.0E+02	5.2E-02	6.0E-03	2.0E+02	3.0E-05
SUMMARY HAZARD INDEX			4.0E+00			1.8E+00			3.7E-02

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.14
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	Barred owl			Short–tailed shrew		
	PDE	RTV	HQ	PDE	RTV	HQ
Antimony	3.0E–06	4.2E+01	7.3E–08	1.0E–02	4.2E+01	2.5E–04
Copper	3.7E–04	1.0E+02	3.7E–06	5.5E–01	1.0E+02	5.5E–03
Lead	5.9E–04	7.5E+01	7.8E–06	2.3E+00	2.5E+00	9.1E–01
Selenium	2.7E–05	6.0E–01	4.6E–05	1.3E–01	2.0E–01	6.7E–01
4,4'–DDE	1.1E–06	3.9E–01	2.8E–06	4.0E–03	2.0E–01	2.0E–02
Aroclor–1260	4.4E–04	9.0E+00	4.9E–05	7.4E–01	6.4E+00	1.2E–01
Dieldrin	1.2E–06	6.0E–01	2.1E–06	4.8E–03	6.5E–01	7.5E–03
Di–n–butylphthalate	1.6E–06	1.1E+00	1.5E–06	4.8E–03	1.1E+00	4.3E–03
Fluoranthene	4.1E–06	1.0E+01	4.1E–07	1.3E–02	1.0E+01	1.3E–03
Phenanthrene	2.1E–06	1.0E+01	2.1E–07	6.4E–03	1.0E+01	6.4E–04
Pyrene	4.1E–06	1.0E+01	4.1E–07	1.3E–02	1.0E+01	1.3E–03
Methylene chloride	1.4E–08	5.3E+01	2.7E–10	3.6E–05	5.3E+01	6.8E–07
Tetrachloroethylene	2.4E–09	1.0E+02	2.4E–11	6.2E–06	1.0E+02	6.2E–08
Toluene	8.8E–09	7.6E+01	1.2E–10	2.2E–05	7.6E+01	3.0E–07
Trichlorofluoromethane	1.2E–08	3.5E+01	3.6E–10	3.2E–05	3.5E+01	9.1E–07
4,4'–DDD	3.2E–07	1.4E–01	2.3E–06	1.2E–03	2.0E–01	5.9E–03
4,4'–DDT	1.5E–06	1.4E–01	1.1E–05	4.3E–03	2.0E–01	2.2E–02
2–Methylnaphthylene	7.7E–07	1.0E+01	7.7E–08	2.4E–03	1.0E+01	2.4E–04
Acenaphthylene	5.2E–07	1.0E+01	5.2E–08	1.6E–03	1.0E+01	1.6E–04
Benzo(k)fluoranthene	1.2E–06	1.0E+01	1.2E–07	3.8E–03	1.0E+01	3.8E–04
Chrysene	1.4E–06	1.0E+01	1.4E–07	4.4E–03	1.0E+01	4.4E–04
Naphthalene	6.0E–07	3.6E+01	1.7E–08	1.9E–03	3.6E+01	5.3E–05
1,2–Dichloroethylene (cis and trans)	1.2E–08	3.0E+01	4.0E–10	3.0E–05	3.0E+01	1.0E–06
Acetone	1.2E–07	6.0E+02	1.9E–10	3.0E–04	6.0E+02	4.9E–07
Ethylbenzene	1.0E–08	2.9E+02	3.5E–11	2.6E–05	2.9E+02	8.9E–08
Arsenic	1.1E–04	1.0E+00	1.1E–04	3.0E–01	5.8E–01	5.1E–01
Barium	1.8E–04	2.0E+02	9.3E–07	5.1E–01	2.0E+02	2.6E–03
Manganese	4.9E–04	4.5E+01	1.1E–05	1.5E+00	4.5E+01	3.3E–02
Zinc	6.6E–03	2.0E+02	3.3E–05	1.0E+01	2.0E+02	5.2E–02
SUMMARY HAZARD INDEX			2.8E–04			2.4E+00

PDE = Potential Dietary Exposure (mg/kgBW/day)   RTV = Reference Toxicity Value (mg/kgBW/day)   HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.15
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	White–footed mouse			American robin			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Antimony	1.2E–02	4.2E+01	2.9E–04	1.5E–02	4.2E+01	3.6E–04	8.1E–06	4.2E+01	1.9E–07
Copper	1.4E+00	1.0E+02	1.4E–02	6.3E–01	1.0E+02	6.3E–03	3.9E–04	1.0E+02	3.9E–06
Lead	6.3E–01	2.5E+00	2.5E–01	1.3E+00	7.5E+01	1.7E–02	6.3E–04	2.5E+00	2.5E–04
Selenium	2.4E–02	2.0E–01	1.2E–01	4.5E–02	6.0E–01	7.5E–02	1.8E–05	2.0E–01	9.0E–05
4,4'–DDE	5.8E–04	2.0E–01	2.9E–03	1.0E–03	3.9E–01	2.7E–03	4.0E–07	1.2E+01	3.3E–08
Aroclor–1260	5.4E–02	6.4E+00	8.4E–03	8.7E–02	9.0E–01	9.7E–02	4.6E–05	7.5E–03	6.1E–03
Dieldrin	7.1E–04	6.5E–01	1.1E–03	1.3E–03	6.0E–01	2.1E–03	4.8E–07	6.5E–01	7.4E–07
Di–n–butylphthalate	1.3E–03	1.1E+00	1.2E–03	2.7E–03	1.1E+00	2.4E–03	1.4E–06	1.1E+00	1.3E–06
Fluoranthene	4.9E–03	1.0E+01	4.9E–04	5.7E–03	1.0E+01	5.7E–04	3.1E–06	1.0E+01	3.1E–07
Phenanthrene	3.3E–03	1.0E+01	3.3E–04	3.8E–03	1.0E+01	3.8E–04	2.1E–06	1.0E+01	2.1E–07
Pyrene	5.2E–03	1.0E+01	5.2E–04	6.1E–03	1.0E+01	6.1E–04	3.3E–06	1.0E+01	3.3E–07
Methylene Chloride	1.7E–05	5.3E+01	3.2E–07	4.6E–05	5.3E+01	8.7E–07	2.6E–08	5.3E+01	4.9E–10
Tetrachloroethylene	2.2E–06	1.0E+02	2.2E–08	6.0E–06	1.0E+02	6.0E–08	3.4E–09	1.0E+02	3.4E–11
Toluene	4.2E–06	7.6E+01	5.5E–08	1.1E–05	7.6E+01	1.5E–07	6.4E–09	7.6E+01	8.4E–11
Trichlorofluoromethane	1.2E–05	3.5E+01	3.4E–07	3.2E–05	3.5E+01	9.2E–07	1.8E–08	3.5E+01	5.2E–10
4,4'–DDD	3.1E–04	2.0E–01	1.6E–03	5.7E–04	1.4E–01	4.1E–03	2.2E–07	1.2E+01	1.8E–08
4,4'–DDT	4.1E–04	2.0E–01	2.0E–03	7.6E–04	1.4E–01	5.5E–03	3.4E–07	1.2E+01	2.9E–08
2–Methylnaphthalene	1.0E–03	1.0E+01	1.0E–04	1.5E–03	1.0E+01	1.5E–04	8.3E–07	1.0E+01	8.3E–08
Acenaphthylene	7.5E–04	1.0E+01	7.5E–05	1.1E–03	1.0E+01	1.1E–04	6.1E–07	1.0E+01	6.1E–08
Benzo[k]fluoranthene	1.5E–03	1.0E+01	1.5E–04	2.3E–03	1.0E+01	2.3E–04	1.3E–06	1.0E+01	1.3E–07
Chrysene	2.2E–03	1.0E+01	2.2E–04	3.4E–03	1.0E+01	3.4E–04	1.8E–06	1.0E+01	1.8E–07
Naphthalene	8.3E–04	3.6E+01	2.3E–05	1.3E–03	3.6E+01	3.5E–05	6.8E–07	3.6E+01	1.9E–08
1,2–Dichloroethylene (cis and trans)	8.8E–06	3.0E+01	2.9E–07	2.4E–05	3.0E+01	8.0E–07	1.4E–08	3.0E+01	4.5E–10
Acetone	7.1E–05	6.0E+02	1.2E–07	1.9E–04	6.0E+02	3.2E–07	1.1E–07	6.0E+02	1.8E–10
Ethylbenzene	7.3E–06	2.9E+02	2.5E–08	2.0E–05	2.9E+02	6.9E–08	1.1E–08	2.9E+02	3.9E–11
Arsenic	8.4E–01	5.8E–01	1.4E+00	4.4E–01	1.0E+00	4.4E–01	2.6E–04	5.8E–01	4.6E–04
Barium	2.8E–01	2.0E+02	1.4E–03	3.8E–01	2.0E+02	1.9E–03	2.2E–04	2.0E+02	1.1E–06
Manganese	1.2E+00	4.5E+01	2.7E–02	1.3E+00	4.5E+01	3.0E–02	7.5E–04	4.5E+01	1.7E–05
Zinc	5.0E+00	2.0E+02	2.5E–02	3.8E+00	2.0E+02	1.9E–02	2.2E–03	2.0E+02	1.1E–05
SUMMARY HAZARD INDEX			1.9E+00			7.1E–01			6.9E–03

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-2.15
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	Barred owl			Short-tailed shrew		
	PDE	RTV	HQ	PDE	RTV	HQ
Antimony	3.0E-06	4.2E+01	7.3E-08	1.0E-02	4.2E+01	2.5E-04
Copper	1.5E-04	1.0E+02	1.5E-06	2.2E-01	1.0E+02	2.2E-03
Lead	2.6E-04	7.5E+01	3.5E-06	1.0E+00	2.5E+00	4.1E-01
Selenium	1.2E-05	6.0E-01	2.0E-05	5.8E-02	2.0E-01	2.9E-01
4,4'-DDE	4.2E-07	3.9E-01	1.1E-06	1.5E-03	2.0E-01	7.7E-03
Aroclor-1260	7.7E-05	9.0E+00	8.5E-06	1.3E-01	6.4E+00	2.0E-02
Dieldrin	4.9E-07	6.0E-01	8.2E-07	1.9E-03	6.5E-01	3.0E-03
Di-n-butylphthalate	6.9E-07	1.1E+00	6.3E-07	2.0E-03	1.1E+00	1.8E-03
Fluoranthene	1.2E-06	1.0E+01	1.2E-07	3.7E-03	1.0E+01	3.7E-04
Phenanthrene	8.0E-07	1.0E+01	8.0E-08	2.5E-03	1.0E+01	2.5E-04
Pyrene	1.3E-06	1.0E+01	1.3E-07	4.0E-03	1.0E+01	4.0E-04
Methylene Chloride	1.2E-08	5.3E+01	2.2E-10	3.0E-05	5.3E+01	5.7E-07
Tetrachloroethylene	1.6E-09	1.0E+02	1.6E-11	4.0E-06	1.0E+02	4.0E-08
Toluene	2.9E-09	7.6E+01	3.9E-11	7.5E-06	7.6E+01	9.9E-08
Trichlorofluoromethane	8.3E-09	3.5E+01	2.4E-10	2.1E-05	3.5E+01	6.1E-07
4,4'-DDD	2.3E-07	1.4E-01	1.6E-06	8.4E-04	2.0E-01	4.2E-03
4,4'-DDT	3.2E-07	1.4E-01	2.3E-06	9.3E-04	2.0E-01	4.7E-03
2-Methylnaphthalene	3.5E-07	1.0E+01	3.5E-08	1.1E-03	1.0E+01	1.1E-04
Acenaphthylene	2.6E-07	1.0E+01	2.6E-08	8.1E-04	1.0E+01	8.1E-05
Benzo[k]fluoranthene	5.4E-07	1.0E+01	5.4E-08	1.7E-03	1.0E+01	1.7E-04
Chrysene	7.8E-07	1.0E+01	7.8E-08	2.4E-03	1.0E+01	2.4E-04
Naphthalene	2.9E-07	3.6E+01	8.1E-09	9.0E-04	3.6E+01	2.5E-05
1,2-Dichloroethylene (cis and trans)	6.2E-09	3.0E+01	2.1E-10	1.6E-05	3.0E+01	5.3E-07
Acetone	5.0E-08	6.0E+02	8.4E-11	1.3E-04	6.0E+02	2.1E-07
Ethylbenzene	5.2E-09	2.9E+02	1.8E-11	1.3E-05	2.9E+02	4.5E-08
Arsenic	5.3E-05	1.0E+00	5.3E-05	1.5E-01	5.8E-01	2.6E-01
Barium	8.4E-05	2.0E+02	4.2E-07	2.3E-01	2.0E+02	1.2E-03
Manganese	2.7E-04	4.5E+01	5.9E-06	8.0E-01	4.5E+01	1.8E-02
Zinc	2.4E-03	2.0E+02	1.2E-05	3.8E+00	2.0E+02	1.9E-02
SUMMARY HAZARD INDEX			1.1E-04			1.0E+00

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.16
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	White–footed mouse			American robin			Red fox		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Arsenic	1.4E+00	5.8E–01	2.5E+00	5.0E–01	1.0E+00	5.0E–01	1.9E–05	5.8E–01	3.3E–05
Barium	0.0E+00	2.0E+02	0.0E+00	0.0E+00	2.0E+02	0.0E+00	0.0E+00	2.0E+02	0.0E+00
Cadmium	5.4E+00	2.2E+01	2.5E–01	1.3E+00	1.0E+01	1.3E–01	3.4E–04	2.2E+01	1.6E–05
Copper	0.0E+00	1.0E+02	0.0E+00	0.0E+00	1.0E+02	0.0E+00	0.0E+00	1.0E+02	0.0E+00
Lead	0.0E+00	2.5E+00	0.0E+00	0.0E+00	7.5E+01	0.0E+00	0.0E+00	2.5E+00	0.0E+00
Manganese	4.4E+00	4.5E+01	9.8E–02	3.3E+00	4.5E+01	7.3E–02	1.3E–04	4.5E+01	2.9E–06
Zinc	0.0E+00	2.0E+02	0.0E+00	0.0E+00	2.0E+02	0.0E+00	0.0E+00	2.0E+02	0.0E+00
4,4'–DDE	1.9E–04	2.0E–01	9.7E–04	2.4E–04	3.9E–01	6.1E–04	2.7E–08	1.2E+01	2.2E–09
4,4'–DDT	2.6E–04	2.0E–01	1.3E–03	3.3E–04	1.4E–01	2.3E–03	3.4E–08	1.2E+01	2.8E–09
Aroclor–1242	0.0E+00	6.4E+00	0.0E+00	0.0E+00	9.0E–01	0.0E+00	0.0E+00	7.5E–03	0.0E+00
Aroclor–1260	4.1E–02	6.4E+00	6.4E–03	4.4E–02	9.0E–01	4.9E–02	7.7E–06	7.5E–03	1.0E–03
Fluoranthene	1.2E–03	1.0E+01	1.2E–04	9.0E–04	1.0E+01	9.0E–05	4.3E–08	1.0E+01	4.3E–09
Naphthalene	4.0E–04	3.6E+01	1.1E–05	3.1E–04	3.6E+01	8.7E–06	1.5E–08	3.6E+01	4.1E–10
Phenanthrene	9.2E–04	1.0E+01	9.2E–05	7.1E–04	1.0E+01	7.1E–05	3.4E–08	1.0E+01	3.4E–09
Pyrene	1.3E–03	1.0E+01	1.3E–04	9.7E–04	1.0E+01	9.7E–05	4.6E–08	1.0E+01	4.6E–09
Tetrachloroethylene	0.0E+00	1.0E+02	0.0E+00	0.0E+00	1.0E+02	0.0E+00	0.0E+00	1.0E+02	0.0E+00
Toluene	7.3E–06	7.6E–02	9.7E–05	1.3E–05	7.6E–02	1.8E–04	5.3E–10	7.6E–02	7.0E–09
Selenium	2.0E–02	2.0E–01	1.0E–01	2.5E–02	6.0E–01	4.2E–02	2.2E–06	2.0E–01	1.1E–05
4,4'–DDD	1.2E–02	2.0E–01	5.9E–02	1.4E–02	1.4E–01	1.0E–01	1.7E–06	1.2E+01	1.4E–07
alpha–Chlordane	6.4E–05	1.6E+01	4.0E–06	7.9E–05	3.1E–02	2.6E–03	7.4E–09	1.6E+01	4.6E–10
gamma–Chlordane	6.4E–05	1.6E+01	4.0E–06	7.9E–05	3.1E–02	2.6E–03	7.4E–09	1.6E+01	4.6E–10
1,2–Dichlorobenzene	3.8E–03	7.6E+02	5.1E–06	2.5E–03	7.6E+02	3.3E–06	1.2E–07	7.6E+02	1.5E–10
1,4–Dichlorobenzene	5.3E–03	7.6E+02	6.9E–06	3.4E–03	7.6E+02	4.5E–06	1.6E–07	7.6E+02	2.1E–10
Bis(2–ethylhexyl)phthalate	0.0E+00	3.5E+01	0.0E+00	0.0E+00	3.5E+01	0.0E+00	0.0E+00	3.5E+01	0.0E+00
1,1,1–Trichloroethane	0.0E+00	1.5E+03	0.0E+00	0.0E+00	1.5E+03	0.0E+00	0.0E+00	1.5E+03	0.0E+00
Chlorobenzene	2.9E–05	8.9E+01	3.3E–07	5.4E–05	8.9E+01	6.0E–07	2.1E–09	8.9E+01	2.4E–11
Trichloroethylene	1.0E–05	4.8E+02	2.1E–08	1.9E–05	4.8E+02	3.9E–08	7.5E–10	4.8E+02	1.6E–12
Xylenes	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			3.0E+00			9.1E–01			1.1E–03

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.16
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	Barred owl PDE	Barred owl RTV	Barred owl HQ
Arsenic	7.0E−05	1.0E+00	7.0E−05
Barium	0.0E+00	2.0E+02	0.0E+00
Cadmium	1.8E−03	1.0E+01	1.8E−04
Copper	0.0E+00	1.0E+02	0.0E+00
Lead	0.0E+00	7.5E+01	0.0E+00
Manganese	6.6E−04	4.5E+01	1.5E−05
Zinc	0.0E+00	2.0E+02	0.0E+00
4,4'−DDE	1.4E−07	3.9E−01	3.7E−07
4,4'−DDT	2.1E−07	1.4E−01	1.5E−06
Aroclor−1242	0.0E+00	9.0E+00	0.0E+00
Aroclor−1260	2.8E−05	9.0E+00	3.1E−06
Fluoranthene	2.1E−07	1.0E+01	2.1E−08
Naphthalene	7.2E−08	3.6E+01	2.0E−09
Phenanthrene	1.7E−07	1.0E+01	1.7E−08
Pyrene	2.3E−07	1.0E+01	2.3E−08
Tetrachloroethylene	0.0E+00	1.0E+02	0.0E+00
Toluene	3.5E−09	7.6E−02	4.6E−08
Selenium	6.7E−06	6.0E−01	1.1E−05
4,4'−DDD	8.5E−06	1.4E−01	6.1E−05
alpha−Chlordane	3.0E−08	3.1E−02	9.7E−07
gamma−Chlordane	3.0E−08	3.1E−02	9.7E−07
1,2−Dichlorobenzene	5.5E−07	7.6E+02	7.3E−10
1,4−Dichlorobenzene	7.6E−07	7.6E+02	1.0E−09
Bis(2−ethylhexyl)phthalate	0.0E+00	3.5E+01	0.0E+00
1,1,1−Trichloroethane	0.0E+00	1.5E+03	0.0E+00
Chlorobenzene	1.4E−08	8.9E+01	1.6E−10
Trichloroethylene	4.9E−09	4.8E+02	1.0E−11
Xylenes	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			3.4E−04

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.17
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	White–footed mouse			American robin			Red fox		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Arsenic	8.7E–01	5.8E–01	1.5E+00	3.0E–01	1.0E+00	3.0E–01	1.1E–05	5.8E–01	2.0E–05
Barium	0.0E+00	2.0E+02	0.0E+00	0.0E+00	2.0E+02	0.0E+00	0.0E+00	2.0E+02	0.0E+00
Cadmium	3.3E+00	2.2E+01	1.5E–01	8.0E–01	1.0E+01	8.0E–02	2.1E–04	2.2E+01	9.9E–06
Copper	0.0E+00	1.0E+02	0.0E+00	0.0E+00	1.0E+02	0.0E+00	0.0E+00	1.0E+02	0.0E+00
Lead	0.0E+00	2.5E+00	0.0E+00	0.0E+00	7.5E+01	0.0E+00	0.0E+00	2.5E+00	0.0E+00
Manganese	1.8E–02	4.5E+01	3.9E–04	1.3E–02	4.5E+01	2.9E–04	5.2E–07	4.5E+01	1.1E–08
Zinc	0.0E+00	2.0E+02	0.0E+00	0.0E+00	2.0E+02	0.0E+00	0.0E+00	2.0E+02	0.0E+00
4,4'–DDE	1.9E–04	2.0E–01	9.7E–04	2.4E–04	3.9E–01	6.1E–04	2.7E–08	1.2E+01	2.2E–09
4,4'–DDT	1.5E–04	2.0E–01	7.3E–04	1.8E–04	1.4E–01	1.3E–03	1.9E–08	1.2E+01	1.6E–09
Aroclor–1242	0.0E+00	6.4E+00	0.0E+00	0.0E+00	9.0E–01	0.0E+00	0.0E+00	7.5E–03	0.0E+00
Aroclor–1260	1.0E–02	6.4E+00	1.6E–03	1.1E–02	9.0E–01	1.3E–02	2.0E–06	7.5E–03	2.6E–04
Fluoranthene	1.2E–03	1.0E+01	1.2E–04	9.0E–04	1.0E+01	9.0E–05	4.3E–08	1.0E+01	4.3E–09
Naphthalene	4.0E–04	3.6E+01	1.1E–05	3.1E–04	3.6E+01	8.7E–06	1.5E–08	3.6E+01	4.1E–10
Phenanthrene	9.2E–04	1.0E+01	9.2E–05	7.1E–04	1.0E+01	7.1E–05	3.4E–08	1.0E+01	3.4E–09
Pyrene	1.3E–03	1.0E+01	1.3E–04	9.7E–04	1.0E+01	9.7E–05	4.6E–08	1.0E+01	4.6E–09
Tetrachloroethylene	0.0E+00	1.0E+02	0.0E+00	0.0E+00	1.0E+02	0.0E+00	0.0E+00	1.0E+02	0.0E+00
Toluene	3.4E–06	7.6E–02	4.5E–05	6.3E–06	7.6E–02	8.2E–05	2.5E–10	7.6E–02	3.3E–09
Selenium	6.1E–03	2.0E–01	3.1E–02	7.6E–03	6.0E–01	1.3E–02	6.6E–07	2.0E–01	3.3E–06
4,4'–DDD	2.7E–03	2.0E–01	1.3E–02	3.3E–03	1.4E–01	2.3E–02	3.8E–07	1.2E+01	3.2E–08
alpha–Chlordane	4.7E–05	1.6E+01	3.0E–06	5.9E–05	3.1E–02	1.9E–03	5.5E–09	1.6E+01	3.5E–10
gamma–Chlordane	4.7E–05	1.6E+01	3.0E–06	5.9E–05	3.1E–01	1.9E–04	5.5E–09	1.6E+01	3.5E–10
1,2–Dichlorobenzene	1.4E–03	7.6E+02	1.9E–06	9.1E–04	7.6E+02	1.2E–06	4.2E–08	7.6E+02	5.6E–11
1,4–Dichlorobenzene	1.7E–03	7.6E+02	2.3E–06	1.1E–03	7.6E+02	1.5E–06	5.2E–08	7.6E+02	6.8E–11
Chlorobenzene	8.1E–06	8.9E+01	9.1E–08	1.5E–05	8.9E+01	1.7E–07	5.9E–10	8.9E+01	6.6E–12
Trichloroethylene	5.1E–06	4.8E+02	1.1E–08	9.4E–06	4.8E+02	2.0E–08	3.7E–10	4.8E+02	7.8E–13
SUMMARY HAZARD INDEX			1.7E+00			4.4E–01			3.0E–04

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O−2.17
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	Barred owl		
	PDE	RTV	HQ
Arsenic	4.2E−05	1.0E+00	4.2E−05
Barium	0.0E+00	2.0E+02	0.0E+00
Cadmium	1.1E−03	1.0E+01	1.1E−04
Copper	0.0E+00	1.0E+02	0.0E+00
Lead	0.0E+00	7.5E+01	0.0E+00
Manganese	2.6E−06	4.5E+01	5.9E−08
Zinc	0.0E+00	2.0E+02	0.0E+00
4,4'−DDE	1.4E−07	3.9E−01	3.7E−07
4,4'−DDT	1.2E−07	1.4E−01	8.3E−07
Aroclor−1242	0.0E+00	9.0E+00	0.0E+00
Aroclor−1260	7.1E−06	9.0E+00	7.9E−07
Fluoranthene	2.1E−07	1.0E+01	2.1E−08
Naphthalene	7.2E−08	3.6E+01	2.0E−09
Phenanthrene	1.7E−07	1.0E+01	1.7E−08
Pyrene	2.3E−07	1.0E+01	2.3E−08
Tetrachloroethylene	0.0E+00	1.0E+02	0.0E+00
Toluene	1.6E−09	7.6E−02	2.1E−08
Selenium	2.0E−06	6.0E−01	3.3E−06
4,4'−DDD	1.9E−06	1.4E−01	1.4E−05
alpha−Chlordane	2.2E−08	3.1E−02	7.2E−07
gamma−Chlordane	2.2E−08	3.1E−02	7.2E−07
1,2−Dichlorobenzene	2.0E−07	7.6E+02	2.7E−10
1,4−Dichlorobenzene	2.5E−07	7.6E+02	3.2E−10
Chlorobenzene	3.8E−09	8.9E+01	4.3E−11
Trichloroethylene	2.4E−09	4.8E+02	5.1E−12
SUMMARY HAZARD INDEX			1.7E−04

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.18
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Muskrat			Mallard			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Aluminum	1.2E+02	4.3E+02	2.8E–01	7.2E–02	4.3E+02	1.7E–04	2.5E–01	4.3E+02	5.8E–04
Arsenic	5.0E+00	5.8E–01	8.6E+00	1.1E–02	1.0E+00	1.1E–02	2.1E–03	5.8E–01	3.6E–03
Barium	1.3E+00	2.0E+02	6.7E–03	1.3E–03	2.0E+02	6.4E–06	1.6E–03	2.0E+02	8.0E–06
Cadmium	5.4E–02	2.2E+01	2.5E–03	1.7E–05	1.0E+01	1.7E–06	7.0E–04	2.2E+01	3.3E–05
Chromium	3.9E–01	3.5E+00	1.1E–01	2.3E–04	2.5E+01	9.1E–06	1.1E–03	3.5E+00	3.2E–04
Cobalt	3.5E–01	4.2E+00	8.4E–02	1.7E–04	4.2E+00	4.0E–05	2.5E–03	4.2E+00	6.0E–04
Copper	2.8E+00	1.0E+02	2.8E–02	2.9E–03	1.0E+02	2.9E–05	1.3E–02	1.0E+02	1.3E–04
Lead	4.2E+00	2.5E+00	1.7E+00	5.3E–03	7.5E+01	7.0E–05	6.6E–03	2.5E+00	2.6E–03
Manganese	5.8E+01	4.5E+01	1.3E+00	9.7E–02	4.5E+01	2.1E–03	9.9E–02	4.5E+01	2.2E–03
Mercury	1.1E–01	9.0E–01	1.2E–01	4.0E–05	6.4E–02	6.3E–04	1.4E–03	1.0E–01	1.4E–02
Nickel	3.8E–01	1.3E+01	2.9E–02	2.5E–04	5.0E+01	5.1E–06	1.3E–03	1.3E+01	9.6E–05
Selenium	1.6E–01	2.0E–01	7.8E–01	2.3E–04	1.8E+00	1.3E–04	5.9E–04	2.0E–01	2.9E–03
Vanadium	6.8E–03	6.0E+00	1.1E–03	1.2E–05	1.1E+01	1.1E–06	1.1E–05	6.0E+00	1.9E–06
Zinc	3.2E+01	2.0E+02	1.6E–01	7.2E–02	2.0E+02	3.6E–04	7.9E–02	2.0E+02	3.9E–04
4,4'–DDD	3.1E–03	2.0E–01	1.6E–02	2.2E–06	1.2E+00	1.9E–06	3.9E–06	1.2E+01	3.2E–07
4,4'–DDE	1.2E–03	2.0E–01	5.8E–03	8.0E–07	5.8E–01	1.4E–06	1.8E–06	1.2E+01	1.5E–07
4,4'–DDT	1.6E–03	2.0E–01	8.0E–03	6.4E–07	1.2E+00	5.5E–07	1.5E–05	1.2E+01	1.2E–06
Aroclor–1260	3.9E–03	6.4E+00	6.1E–04	6.8E–06	9.0E–01	7.5E–06	9.1E–06	7.5E–03	1.2E–03
Dieldrin	3.5E–04	6.5E–01	5.3E–04	2.8E–07	2.2E+00	1.3E–07	4.0E–07	6.5E–01	6.2E–07
Benzo[k]fluoranthene	2.9E–02	1.0E+01	2.9E–03	3.4E–05	1.0E+01	3.4E–06	4.0E–05	1.0E+01	4.0E–06
Bis(2–ethylhexyl)phthalate	5.1E–02	3.5E+01	1.5E–03	1.6E–05	3.5E+01	4.7E–07	6.6E–04	3.5E+01	1.9E–05
Fluoranthene	5.7E–02	1.0E+01	5.7E–03	6.8E–05	1.0E+01	6.8E–06	7.9E–05	1.0E+01	7.9E–06
Phenanthrene	2.9E–02	1.0E+01	2.9E–03	3.4E–05	1.0E+01	3.4E–06	4.1E–05	1.0E+01	4.1E–06
Pyrene	5.7E–02	1.0E+01	5.7E–03	6.8E–05	1.0E+01	6.8E–06	7.9E–05	1.0E+01	7.9E–06
1,2–Dichloroethylenes (cis and trans)	2.5E–03	3.0E+01	8.2E–05	4.4E–06	3.0E+01	1.5E–07	4.1E–06	3.0E+01	1.4E–07
Acetone	2.1E–03	6.0E+02	3.4E–06	1.0E–06	6.0E+02	1.7E–09	2.7E–06	6.0E+02	4.5E–09
Methylene chloride	1.4E–03	5.3E+01	2.6E–05	1.2E–06	5.3E+01	2.3E–08	2.0E–06	5.3E+01	3.7E–08
Tetrachloroethylene	6.9E–04	1.0E+02	6.9E–06	5.6E–07	1.0E+02	5.6E–09	9.7E–07	1.0E+02	9.7E–09
Toluene	2.4E–04	7.6E+01	3.1E–06	2.5E–07	7.6E+01	3.3E–09	3.5E–07	7.6E+01	4.6E–09
Trichlorofluoromethane	5.0E–04	3.5E+01	1.4E–05	2.5E–07	3.5E+01	7.2E–09	6.7E–07	3.5E+01	1.9E–08

Table O–2.18
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	*Muskrat*			*Mallard*			*Raccoon*		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
1,2–Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
1,4–Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
Benzo(b)fluoranthene	0.0E+00	1.0E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00
Chrysene	9.9E–03	1.0E+01	9.9E–04	4.1E–06	1.0E+01	4.1E–07	1.6E–05	1.0E+01	1.6E–06
Naphthalene	0.0E+00	3.6E+01	0.0E+00	0.0E+00	3.6E+01	0.0E+00	0.0E+00	3.6E+01	0.0E+00
Benzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
Carbon disulfide	1.0E–04	1.1E+01	9.4E–06	1.8E–07	1.1E+01	1.7E–08	1.7E–07	1.1E+01	1.6E–08
Chlorobenzene	0.0E+00	8.9E+01	0.0E+00	0.0E+00	8.9E+01	0.0E+00	0.0E+00	8.9E+01	0.0E+00
Chloroform	6.8E–05	1.6E+02	4.1E–07	1.2E–07	1.6E+02	7.4E–10	1.1E–07	1.6E+02	6.9E–10
Trichloroethylene	5.1E–04	4.8E+02	1.1E–06	6.8E–07	4.8E+02	1.4E–09	7.9E–07	4.8E+02	1.6E–09
Xylene	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			1.3E+01			1.5E–02			2.8E–02

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.18
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Great blue heron		
	PDE	RTV	HQ
Aluminum	6.3E+01	4.3E+02	1.5E–01
Arsenic	2.5E–01	1.0E+00	2.5E–01
Barium	1.9E–01	2.0E+02	9.5E–04
Cadmium	3.2E–01	1.0E+01	3.2E–02
Chromium	3.6E–01	2.5E+01	1.4E–02
Cobalt	1.1E+00	4.2E+00	2.6E–01
Copper	5.4E+00	1.0E+02	5.4E–02
Lead	1.7E+00	7.5E+01	2.2E–02
Manganese	3.3E+01	4.5E+01	7.3E–01
Mercury	6.3E–01	6.4E–02	9.8E+00
Nickel	4.4E–01	5.0E+01	8.8E–03
Selenium	2.5E–01	6.0E–01	4.1E–01
Vanadium	7.6E–04	1.1E+01	6.9E–05
Zinc	3.5E+01	2.0E+02	1.8E–01
4,4'–DDD	2.6E–03	1.4E–01	1.9E–02
4,4'–DDE	2.3E–03	3.9E–01	6.0E–03
4,4'–DDT	6.6E–03	1.4E–01	4.7E–02
Aroclor–1260	6.6E–03	9.0E+00	7.3E–04
Dieldrin	1.3E–04	6.0E–01	2.1E–04
Benzo[k]fluoranthene	8.7E–03	1.0E+01	8.7E–04
Bis(2–ethylhexyl)phthalate	3.1E–01	3.5E+01	8.7E–03
Fluoranthene	1.7E–02	1.0E+01	1.7E–03
Phenanthrene	9.5E–03	1.0E+01	9.5E–04
Pyrene	1.7E–02	1.0E+01	1.7E–03
1,2–Dichloroethylenes (cis and trans)	2.7E–04	3.0E+01	9.2E–06
Acetone	2.6E–04	6.0E+02	4.3E–07
Methylene chloride	1.7E–04	5.3E+01	3.2E–06
Tetrachloroethylene	8.4E–05	1.0E+02	8.4E–07
Toluene	2.8E–05	7.6E+01	3.7E–07
Trichlorofluoromethane	6.4E–05	3.5E+01	1.8E–06

Table O-2.18
Risk from Lethal or Sublethal Effects for Semi-Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Great blue heron		
	PDE	RTV	HQ
1,2-Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00
1,4-Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00
Benzo(b)fluoranthene	0.0E+00	1.0E+01	0.0E+00
Chrysene	3.5E-03	1.0E+01	3.5E-04
Naphthalene	0.0E+00	3.6E+01	0.0E+00
Benzene	0.0E+00	7.6E+02	0.0E+00
Carbon disulfide	1.2E-05	1.1E+01	1.1E-06
Chlorobenzene	0.0E+00	8.9E+01	0.0E+00
Chloroform	7.6E-06	1.6E+02	4.6E-08
Trichloroethylene	6.0E-05	4.8E+02	1.2E-07
Xylene	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			1.2E+01

PDE = Potential Dietary Exposure (mg/kgBW-day). RTV = Reference Toxicity Value (mg/kgBW-day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.19
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Muskrat			Mallard			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Aluminum	8.6E+01	4.3E+02	2.0E–01	5.1E–02	4.3E+02	1.2E–04	1.8E–01	4.3E+02	4.2E–04
Arsenic	1.6E+00	5.8E–01	2.7E+00	3.6E–03	1.0E+00	3.6E–03	6.7E–04	5.8E–01	1.1E–03
Barium	5.7E–01	2.0E+02	2.9E–03	5.4E–04	2.0E+02	2.7E–06	6.8E–04	2.0E+02	3.5E–06
Cadmium	1.3E–02	2.2E+01	5.9E–04	4.0E–06	1.0E+01	4.0E–07	1.6E–04	2.2E+01	7.6E–06
Chromium	1.9E–01	3.5E+00	5.3E–02	1.1E–04	2.5E+01	4.3E–06	5.3E–04	3.5E+00	1.5E–04
Cobalt	2.1E–01	4.2E+00	4.9E–02	9.7E–05	4.2E+00	2.3E–05	1.5E–03	4.2E+00	3.5E–04
Copper	6.3E–01	1.0E+02	6.3E–03	6.6E–04	1.0E+02	6.6E–06	2.7E–03	1.0E+02	2.7E–05
Lead	1.8E+00	2.5E+00	7.1E–01	2.2E–03	7.5E+01	2.9E–05	2.8E–03	2.5E+00	1.1E–03
Manganese	1.9E+01	4.5E+01	4.2E–01	3.0E–02	4.5E+01	6.6E–04	4.6E–02	4.5E+01	1.0E–03
Mercury	6.1E–02	9.0E–01	6.7E–02	1.8E–05	6.4E–02	2.8E–04	7.9E–04	1.0E–01	7.9E–03
Nickel	2.6E–01	1.3E+01	2.0E–02	1.7E–04	5.0E+01	3.5E–06	8.5E–04	1.3E+01	6.6E–05
Selenium	4.6E–02	2.0E–01	2.3E–01	7.0E–05	1.8E+00	4.0E–05	1.8E–04	2.0E–01	8.8E–04
Vanadium	1.6E–03	6.0E+00	2.6E–04	2.8E–06	1.1E+01	2.5E–07	2.6E–06	6.0E+00	4.3E–07
Zinc	1.4E+01	2.0E+02	6.9E–02	3.2E–02	2.0E+02	1.6E–04	3.5E–02	2.0E+02	1.7E–04
4,4'–DDD	1.1E–03	2.0E–01	5.3E–03	7.2E–07	1.2E+00	6.2E–07	1.3E–06	1.2E+01	1.1E–07
4,4'–DDE	4.0E–04	2.0E–01	2.0E–03	2.8E–07	5.8E–01	4.8E–07	8.6E–07	1.2E+01	7.2E–08
4,4'–DDT	8.4E–04	2.0E–01	4.2E–03	3.3E–07	1.2E+00	2.9E–07	7.8E–06	1.2E+01	6.5E–07
Aroclor–1260	9.0E–04	6.4E+00	1.4E–04	1.6E–06	9.0E–01	1.7E–06	7.1E–06	7.5E–03	9.5E–04
Dieldrin	7.2E–05	6.5E–01	1.1E–04	5.8E–08	2.2E+00	2.6E–08	8.4E–08	6.5E–01	1.3E–07
Benzo[k]fluoranthene	5.5E–03	1.0E+01	5.5E–04	6.6E–06	1.0E+01	6.6E–07	7.7E–06	1.0E+01	7.7E–07
Bis(2–ethylhexyl)phthalate	1.0E–02	3.5E+01	2.9E–04	3.3E–06	3.5E+01	9.3E–08	1.3E–04	3.5E+01	3.8E–06
Fluoranthene	2.1E–02	1.0E+01	2.1E–03	2.5E–05	1.0E+01	2.5E–06	2.9E–05	1.0E+01	2.9E–06
Phenanthrene	8.0E–03	1.0E+01	8.0E–04	9.2E–06	1.0E+01	9.2E–07	1.5E–05	1.0E+01	1.5E–06
Pyrene	2.2E–02	1.0E+01	2.2E–03	2.6E–05	1.0E+01	2.6E–06	3.0E–05	1.0E+01	3.0E–06
1,2–Dichloroethylenes (cis and trans)	2.9E–04	3.0E+01	9.8E–06	5.2E–07	3.0E+01	1.7E–08	4.9E–07	3.0E+01	1.6E–08
Acetone	5.3E–04	6.0E+02	8.9E–07	2.7E–07	6.0E+02	4.4E–10	7.1E–07	6.0E+02	1.2E–09
Methylene chloride	3.1E–04	5.3E+01	6.0E–06	3.7E–07	5.3E+01	7.1E–09	4.7E–07	5.3E+01	9.0E–09
Tetrachloroethylene	1.7E–04	1.0E+02	1.7E–06	2.2E–07	1.0E+02	2.2E–09	2.6E–07	1.0E+02	2.6E–09
Toluene	6.6E–05	7.6E+01	8.6E–07	7.4E–08	7.6E+01	9.8E–10	9.8E–08	7.6E+01	1.3E–09
Trichlorofluoromethane	8.6E–05	3.5E+01	2.5E–06	4.3E–08	3.5E+01	1.2E–09	1.1E–07	3.5E+01	3.3E–09

Table O–2.19
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Muskrat			Mallard			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
1,2–Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
1,4–Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
Benzo(b)fluoranthene	0.0E+00	1.0E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00
Chrysene	3.9E–03	1.0E+01	3.9E–04	1.6E–06	1.0E+01	1.6E–07	6.2E–06	1.0E+01	6.2E–07
Naphthalene	0.0E+00	3.6E+01	0.0E+00	0.0E+00	3.6E+01	0.0E+00	0.0E+00	3.6E+01	0.0E+00
Benzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
Carbon disulfide	3.3E–05	1.1E+01	3.0E–06	5.8E–08	1.1E+01	5.3E–09	5.4E–08	1.1E+01	4.9E–09
Chlorobenzene	0.0E+00	8.9E+01	0.0E+00	0.0E+00	8.9E+01	0.0E+00	0.0E+00	8.9E+01	0.0E+00
Chloroform	2.9E–05	1.6E+02	1.7E–07	5.1E–08	1.6E+02	3.1E–10	4.7E–08	1.6E+02	2.9E–10
Trichloroethylene	8.9E–05	4.8E+02	1.9E–07	1.2E–07	4.8E+02	2.6E–10	1.4E–07	4.8E+02	2.9E–10
Xylene	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			4.6E+00			5.0E–03			1.4E–02

PDE = Potential Dietary Exposure (mg/kgBW–day).   RTV = Reference Toxicity Value (mg/kgBW–day)   HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-2.19
Risk from Lethal or Sublethal Effects for Semi-Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sedimer
Area 2

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Devens, Massachusetts

CHEMICAL	Great blue heron		
	PDE	RTV	HQ
Aluminum	4.6E+01	4.3E+02	1.1E-01
Arsenic	7.9E-02	1.0E+00	7.9E-02
Barium	8.2E-02	2.0E+02	4.1E-04
Cadmium	7.6E-02	1.0E+01	7.6E-03
Chromium	1.7E-01	2.5E+01	6.8E-03
Cobalt	6.3E-01	4.2E+00	1.5E-01
Copper	1.1E+00	1.0E+02	1.1E-02
Lead	7.1E-01	7.5E+01	9.5E-03
Manganese	1.8E+01	4.5E+01	3.9E-01
Mercury	3.7E-01	6.4E-02	5.7E+00
Nickel	3.0E-01	5.0E+01	6.0E-03
Selenium	7.4E-02	6.0E-01	1.2E-01
Vanadium	1.8E-04	1.1E+01	1.6E-05
Zinc	1.5E+01	2.0E+02	7.7E-02
4,4'-DDD	2.4E-03	1.4E-01	1.7E-02
4,4'-DDE	2.2E-03	3.9E-01	5.8E-03
4,4'-DDT	3.5E-03	1.4E-01	2.5E-02
Aroclor-1260	6.4E-03	9.0E+00	7.1E-04
Dieldrin	9.7E-05	6.0E-01	1.6E-04
Benzo[k]fluoranthene	1.7E-03	1.0E+01	1.7E-04
Bis(2-ethylhexyl)phthalate	6.1E-02	3.5E+01	1.7E-03
Fluoranthene	6.3E-03	1.0E+01	6.3E-04
Phenanthrene	4.4E-03	1.0E+01	4.4E-04
Pyrene	6.6E-03	1.0E+01	6.6E-04
1,2-Dichloroethylenes (cis and trans)	3.3E-05	3.0E+01	1.1E-06
Acetone	6.7E-05	6.0E+02	1.1E-07
Methylene chloride	3.7E-05	5.3E+01	7.1E-07
Tetrachloroethylene	2.0E-05	1.0E+02	2.0E-07
Toluene	7.8E-06	7.6E+01	1.0E-07
Trichlorofluoromethane	1.1E-05	3.5E+01	3.1E-07

Table O–2.19
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sedimer
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Great blue heron		
	PDE	RTV	HQ
1,2–Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00
1,4–Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00
Benzo(b)fluoranthene	0.0E+00	1.0E+01	0.0E+00
Chrysene	1.4E–03	1.0E+01	1.4E–04
Naphthalene	0.0E+00	3.6E+01	0.0E+00
Benzene	0.0E+00	7.6E+02	0.0E+00
Carbon disulfide	3.6E–06	1.1E+01	3.3E–07
Chlorobenzene	0.0E+00	8.9E+01	0.0E+00
Chloroform	3.2E–06	1.6E+02	1.9E–08
Trichloroethylene	1.0E–05	4.8E+02	2.2E–08
Xylene	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			6.8E+00

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.20
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Muskrat			Mallard			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Aluminum	1.2E+02	4.3E+02	2.8E−01	7.0E−02	4.3E+02	1.6E−04	2.5E−01	4.3E+02	5.8E−04
Arsenic	5.0E+00	5.8E−01	8.5E+00	1.1E−02	1.0E+00	1.1E−02	2.1E−03	5.8E−01	3.6E−03
Barium	1.3E+00	2.0E+02	6.4E−03	1.2E−03	2.0E+02	5.9E−06	1.5E−03	2.0E+02	7.6E−06
Cadmium	0.0E+00	2.2E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00	0.0E+00	2.2E+01	0.0E+00
Chromium	3.9E−01	3.5E+00	1.1E−01	2.2E−04	2.5E+01	8.9E−06	1.1E−03	3.5E+00	3.2E−04
Cobalt	3.5E−01	4.2E+00	8.4E−02	1.7E−04	4.2E+00	4.0E−05	2.5E−03	4.2E+00	6.0E−04
Copper	2.2E+00	1.0E+02	2.2E−02	2.7E−03	1.0E+02	2.7E−05	4.6E−03	1.0E+02	4.6E−05
Lead	4.1E+00	2.5E+00	1.7E+00	5.1E−03	7.5E+01	6.8E−05	6.4E−03	2.5E+00	2.6E−03
Manganese	5.9E+01	4.5E+01	1.3E+00	9.7E−02	4.5E+01	2.1E−03	1.1E−01	4.5E+01	2.4E−03
Mercury	4.7E−02	9.0E−01	5.3E−02	2.5E−05	6.4E−02	3.9E−04	5.5E−04	1.0E−01	5.5E−03
Nickel	3.8E−01	1.3E+01	2.9E−02	2.5E−04	5.0E+01	5.1E−06	1.3E−03	1.3E+01	9.6E−05
Selenium	1.5E−01	2.0E−01	7.7E−01	2.3E−04	1.8E+00	1.3E−04	5.9E−04	2.0E−01	2.9E−03
Vanadium	0.0E+00	6.0E+00	0.0E+00	0.0E+00	1.1E+01	0.0E+00	0.0E+00	6.0E+00	0.0E+00
Zinc	3.1E+01	2.0E+02	1.6E−01	7.2E−02	2.0E+02	3.6E−04	7.9E−02	2.0E+02	3.9E−04
4,4'–DDD	3.1E−03	2.0E−01	1.6E−02	2.2E−06	1.2E+00	1.9E−06	3.9E−06	1.2E+01	3.2E−07
4,4'–DDE	1.2E−03	2.0E−01	5.8E−03	8.0E−07	5.8E−01	1.4E−06	1.8E−06	1.2E+01	1.5E−07
4,4'–DDT	1.6E−03	2.0E−01	8.0E−03	6.4E−07	1.2E+00	5.5E−07	1.5E−05	1.2E+01	1.2E−06
Aroclor–1260	3.9E−03	6.4E+00	6.1E−04	6.8E−06	9.0E−01	7.5E−06	9.1E−06	7.5E−03	1.2E−03
Dieldrin	3.5E−04	6.5E−01	5.3E−04	2.8E−07	2.2E+00	1.3E−07	4.0E−07	6.5E−01	6.2E−07
Benzo[k]fluoranthene	2.9E−02	1.0E+01	2.9E−03	3.4E−05	1.0E+01	3.4E−06	4.0E−05	1.0E+01	4.0E−06
Bis(2–ethylhexyl)phthalate	5.1E−02	3.5E+01	1.5E−03	1.6E−05	3.5E+01	4.7E−07	6.6E−04	3.5E+01	1.9E−05
Fluoranthene	5.7E−02	1.0E+01	5.7E−03	6.8E−05	1.0E+01	6.8E−06	7.9E−05	1.0E+01	7.9E−06
Phenanthrene	2.9E−02	1.0E+01	2.9E−03	3.4E−05	1.0E+01	3.4E−06	4.1E−05	1.0E+01	4.1E−06
Pyrene	5.7E−02	1.0E+01	5.7E−03	6.8E−05	1.0E+01	6.8E−06	7.9E−05	1.0E+01	7.9E−06
1,2–Dichloroethylenes (cis and trans)	2.5E−03	3.0E+01	8.2E−05	4.4E−06	3.0E+01	1.5E−07	4.1E−06	3.0E+01	1.4E−07
Acetone	2.1E−03	6.0E+02	3.4E−06	1.0E−06	6.0E+02	1.7E−09	2.7E−06	6.0E+02	4.5E−09
Methylene chloride	1.4E−03	5.3E+01	2.6E−05	1.2E−06	5.3E+01	2.3E−08	2.0E−06	5.3E+01	3.7E−08
Tetrachloroethylene	6.9E−04	1.0E+02	6.9E−06	5.6E−07	1.0E+02	5.6E−09	9.7E−07	1.0E+02	9.7E−09
Toluene	2.4E−04	7.6E+01	3.1E−06	2.5E−07	7.6E+01	3.3E−09	3.5E−07	7.6E+01	4.6E−09
Trichlorofluoromethane	5.0E−04	3.5E+01	1.4E−05	2.5E−07	3.5E+01	7.2E−09	6.7E−07	3.5E+01	1.9E−08

Table O−2.20
Risk from Lethal or Sublethal Effects for Semi−Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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Devens, Massachusetts

CHEMICAL	Muskrat PDE	Muskrat RTV	Muskrat HQ	Mallard PDE	Mallard RTV	Mallard HQ	Raccoon PDE	Raccoon RTV	Raccoon HQ
1,2−Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
1,4−Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
Benzo(b)fluoranthene	0.0E+00	1.0E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00
Chrysene	9.9E−03	1.0E+01	9.9E−04	4.1E−06	1.0E+01	4.1E−07	1.6E−05	1.0E+01	1.6E−06
Naphthalene	0.0E+00	3.6E+01	0.0E+00	0.0E+00	3.6E+01	0.0E+00	0.0E+00	3.6E+01	0.0E+00
Benzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
Carbon disulfide	1.0E−04	1.1E+01	9.4E−06	1.8E−07	1.1E+01	1.7E−08	1.7E−07	1.1E+01	1.6E−08
Chlorobenzene	0.0E+00	8.9E+01	0.0E+00	0.0E+00	8.9E+01	0.0E+00	0.0E+00	8.9E+01	0.0E+00
Chloroform	6.8E−05	1.6E+02	4.1E−07	1.2E−07	1.6E+02	7.4E−10	1.1E−07	1.6E+02	6.9E−10
Trichloroethylene	5.1E−04	4.8E+02	1.1E−06	6.8E−07	4.8E+02	1.4E−09	7.9E−07	4.8E+02	1.6E−09
Xylene	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			1.3E+01			1.5E−02			2.0E−02

PDE = Potential Dietary Exposure (mg/kgBW−day). RTV = Reference Toxicity Value (mg/kgBW−day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O−2.20
Risk from Lethal or Sublethal Effects for Semi−Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

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Devens, Massachusetts

CHEMICAL	Great blue heron		
	PDE	RTV	HQ
Aluminum	6.2E+01	4.3E+02	1.5E−01
Arsenic	2.4E−01	1.0E+00	2.4E−01
Barium	1.8E−01	2.0E+02	9.2E−04
Cadmium	0.0E+00	1.0E+01	0.0E+00
Chromium	3.6E−01	2.5E+01	1.4E−02
Cobalt	1.1E+00	4.2E+00	2.6E−01
Copper	1.5E+00	1.0E+02	1.5E−02
Lead	1.7E+00	7.5E+01	2.2E−02
Manganese	3.6E+01	4.5E+01	8.1E−01
Mercury	2.5E−01	6.4E−02	3.9E+00
Nickel	4.4E−01	5.0E+01	8.8E−03
Selenium	2.5E−01	6.0E−01	4.1E−01
Vanadium	0.0E+00	1.1E+01	0.0E+00
Zinc	3.5E+01	2.0E+02	1.8E−01
4,4'−DDD	2.6E−03	1.4E−01	1.9E−02
4,4'−DDE	2.3E−03	3.9E−01	6.0E−03
4,4'−DDT	6.6E−03	1.4E−01	4.7E−02
Aroclor−1260	6.6E−03	9.0E+00	7.3E−04
Dieldrin	1.3E−04	6.0E−01	2.1E−04
Benzo[k]fluoranthene	8.7E−03	1.0E+01	8.7E−04
Bis(2−ethylhexyl)phthalate	3.1E−01	3.5E+01	8.7E−03
Fluoranthene	1.7E−02	1.0E+01	1.7E−03
Phenanthrene	9.5E−03	1.0E+01	9.5E−04
Pyrene	1.7E−02	1.0E+01	1.7E−03
1,2−Dichloroethylenes (cis and trans)	2.7E−04	3.0E+01	9.2E−06
Acetone	2.6E−04	6.0E+02	4.3E−07
Methylene chloride	1.7E−04	5.3E+01	3.2E−06
Tetrachloroethylene	8.4E−05	1.0E+02	8.4E−07
Toluene	2.8E−05	7.6E+01	3.7E−07
Trichlorofluoromethane	6.4E−05	3.5E+01	1.8E−06

Table O–2.20
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Great blue heron		
	PDE	RTV	HQ
1,2–Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00
1,4–Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00
Benzo(b)fluoranthene	0.0E+00	1.0E+01	0.0E+00
Chrysene	3.5E–03	1.0E+01	3.5E–04
Naphthalene	0.0E+00	3.6E+01	0.0E+00
Benzene	0.0E+00	7.6E+02	0.0E+00
Carbon disulfide	1.2E–05	1.1E+01	1.1E–06
Chlorobenzene	0.0E+00	8.9E+01	0.0E+00
Chloroform	7.6E–06	1.6E+02	4.6E–08
Trichloroethylene	6.0E–05	4.8E+02	1.2E–07
Xylene	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			6.1E+00

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O−2.21
Risk from Lethal or Sublethal Effects for Semi−Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Muskrat			Mallard			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Aluminum	8.6E+01	4.3E+02	2.0E−01	5.1E−02	4.3E+02	1.2E−04	1.8E−01	4.3E+02	4.2E−04
Arsenic	1.6E+00	5.8E−01	2.7E+00	3.6E−03	1.0E+00	3.6E−03	6.6E−04	5.8E−01	1.1E−03
Barium	5.6E−01	2.0E+02	2.8E−03	5.2E−04	2.0E+02	2.6E−06	6.6E−04	2.0E+02	3.3E−06
Cadmium	0.0E+00	2.2E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00	0.0E+00	2.2E+01	0.0E+00
Chromium	1.9E−01	3.5E+00	5.3E−02	1.1E−04	2.5E+01	4.2E−06	5.3E−04	3.5E+00	1.5E−04
Cobalt	2.1E−01	4.2E+00	4.9E−02	9.7E−05	4.2E+00	2.3E−05	1.5E−03	4.2E+00	3.5E−04
Copper	5.1E−01	1.0E+02	5.1E−03	6.2E−04	1.0E+02	6.2E−06	1.1E−03	1.0E+02	1.1E−05
Lead	1.8E+00	2.5E+00	7.1E−01	2.2E−03	7.5E+01	2.9E−05	2.7E−03	2.5E+00	1.1E−03
Manganese	1.8E+01	4.5E+01	4.1E−01	3.0E−02	4.5E+01	6.6E−04	4.0E−02	4.5E+01	8.8E−04
Mercury	1.1E−02	9.0E−01	1.2E−02	5.7E−06	6.4E−02	8.8E−05	1.2E−04	1.0E−01	1.2E−03
Nickel	2.6E−01	1.3E+01	2.0E−02	1.7E−04	5.0E+01	3.5E−06	8.5E−04	1.3E+01	6.6E−05
Selenium	4.6E−02	2.0E−01	2.3E−01	7.0E−05	1.8E+00	4.0E−05	1.8E−04	2.0E−01	8.8E−04
Vanadium	0.0E+00	6.0E+00	0.0E+00	0.0E+00	1.1E+01	0.0E+00	0.0E+00	6.0E+00	0.0E+00
Zinc	1.4E+01	2.0E+02	6.9E−02	3.2E−02	2.0E+02	1.6E−04	3.5E−02	2.0E+02	1.7E−04
4,4'−DDD	1.1E−03	2.0E−01	5.3E−03	7.2E−07	1.2E+00	6.2E−07	1.3E−06	1.2E+01	1.1E−07
4,4'−DDE	4.0E−04	2.0E−01	2.0E−03	2.8E−07	5.8E−01	4.8E−07	8.6E−07	1.2E+01	7.2E−08
4,4'−DDT	8.4E−04	2.0E−01	4.2E−03	3.3E−07	1.2E+00	2.9E−07	7.8E−06	1.2E+01	6.5E−07
Aroclor−1260	9.0E−04	6.4E+00	1.4E−04	1.6E−06	9.0E−01	1.7E−06	7.1E−06	7.5E−03	9.5E−04
Dieldrin	7.2E−05	6.5E−01	1.1E−04	5.8E−08	2.2E+00	2.6E−08	8.4E−08	6.5E−01	1.3E−07
Benzo[k]fluoranthene	5.5E−03	1.0E+01	5.5E−04	6.6E−06	1.0E+01	6.6E−07	7.7E−06	1.0E+01	7.7E−07
Bis(2−ethylhexyl)phthalate	1.0E−02	3.5E+01	2.9E−04	3.3E−06	3.5E+01	9.3E−08	1.3E−04	3.5E+01	3.8E−06
Fluoranthene	2.1E−02	1.0E+01	2.1E−03	2.5E−05	1.0E+01	2.5E−06	2.9E−05	1.0E+01	2.9E−06
Phenanthrene	8.0E−03	1.0E+01	8.0E−04	9.2E−06	1.0E+01	9.2E−07	1.5E−05	1.0E+01	1.5E−06
Pyrene	2.2E−02	1.0E+01	2.2E−03	2.6E−05	1.0E+01	2.6E−06	3.0E−05	1.0E+01	3.0E−06
1,2−Dichloroethylenes (cis and trans)	2.9E−04	3.0E+01	9.8E−06	5.2E−07	3.0E+01	1.7E−08	4.9E−07	3.0E+01	1.6E−08
Acetone	5.3E−04	6.0E+02	8.9E−07	2.7E−07	6.0E+02	4.4E−10	7.1E−07	6.0E+02	1.2E−09
Methylene chloride	3.1E−04	5.3E+01	6.0E−06	3.7E−07	5.3E+01	7.1E−09	4.7E−07	5.3E+01	9.0E−09
Tetrachloroethylene	1.7E−04	1.0E+02	1.7E−06	2.2E−07	1.0E+02	2.2E−09	2.6E−07	1.0E+02	2.6E−09
Toluene	6.6E−05	7.6E+01	8.6E−07	7.4E−08	7.6E+01	9.8E−10	9.8E−08	7.6E+01	1.3E−09
Trichlorofluoromethane	8.6E−05	3.5E+01	2.5E−06	4.3E−08	3.5E+01	1.2E−09	1.1E−07	3.5E+01	3.3E−09

Table O−2.21
Risk from Lethal or Sublethal Effects for Semi−Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Muskrat			Mallard			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
1,2−Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
1,4−Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
Benzo(b)fluoranthene	0.0E+00	1.0E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00	0.0E+00	1.0E+01	0.0E+00
Chrysene	3.9E−03	1.0E+01	3.9E−04	1.6E−06	1.0E+01	1.6E−07	6.2E−06	1.0E+01	6.2E−07
Naphthalene	0.0E+00	3.6E+01	0.0E+00	0.0E+00	3.6E+01	0.0E+00	0.0E+00	3.6E+01	0.0E+00
Benzene	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00	0.0E+00	7.6E+02	0.0E+00
Carbon disulfide	3.3E−05	1.1E+01	3.0E−06	5.8E−08	1.1E+01	5.3E−09	5.4E−08	1.1E+01	4.9E−09
Chlorobenzene	0.0E+00	8.9E+01	0.0E+00	0.0E+00	8.9E+01	0.0E+00	0.0E+00	8.9E+01	0.0E+00
Chloroform	2.9E−05	1.6E+02	1.7E−07	5.1E−08	1.6E+02	3.1E−10	4.7E−08	1.6E+02	2.9E−10
Trichloroethylene	8.9E−05	4.8E+02	1.9E−07	1.2E−07	4.8E+02	2.6E−10	1.4E−07	4.8E+02	2.9E−10
Xylene	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			4.5E+00			4.8E−03			7.4E−03

PDE = Potential Dietary Exposure (mg/kgBW−day). RTV = Reference Toxicity Value (mg/kgBW−day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O−2.21
Risk from Lethal or Sublethal Effects for Semi−Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Great blue heron		
	PDE	RTV	HQ
Aluminum	4.6E+01	4.3E+02	1.1E−01
Arsenic	7.8E−02	1.0E+00	7.8E−02
Barium	8.0E−02	2.0E+02	4.1E−04
Cadmium	0.0E+00	1.0E+01	0.0E+00
Chromium	1.7E−01	2.5E+01	6.8E−03
Cobalt	6.3E−01	4.2E+00	1.5E−01
Copper	3.5E−01	1.0E+02	3.5E−03
Lead	7.1E−01	7.5E+01	9.4E−03
Manganese	1.4E+01	4.5E+01	3.2E−01
Mercury	5.7E−02	6.4E−02	8.8E−01
Nickel	3.0E−01	5.0E+01	6.0E−03
Selenium	7.4E−02	6.0E−01	1.2E−01
Vanadium	0.0E+00	1.1E+01	0.0E+00
Zinc	1.5E+01	2.0E+02	7.7E−02
4,4'−DDD	2.4E−03	1.4E−01	1.7E−02
4,4'−DDE	2.2E−03	3.9E−01	5.8E−03
4,4'−DDT	3.5E−03	1.4E−01	2.5E−02
Aroclor−1260	6.4E−03	9.0E+00	7.1E−04
Dieldrin	9.7E−05	6.0E−01	1.6E−04
Benzo[k]fluoranthene	1.7E−03	1.0E+01	1.7E−04
Bis(2−ethylhexyl)phthalate	6.1E−02	3.5E+01	1.7E−03
Fluoranthene	6.3E−03	1.0E+01	6.3E−04
Phenanthrene	4.4E−03	1.0E+01	4.4E−04
Pyrene	6.6E−03	1.0E+01	6.6E−04
1,2−Dichloroethylenes (cis and trans)	3.3E−05	3.0E+01	1.1E−06
Acetone	6.7E−05	6.0E+02	1.1E−07
Methylene chloride	3.7E−05	5.3E+01	7.1E−07
Tetrachloroethylene	2.0E−05	1.0E+02	2.0E−07
Toluene	7.8E−06	7.6E+01	1.0E−07
Trichlorofluoromethane	1.1E−05	3.5E+01	3.1E−07

Table O-2.21
Risk from Lethal or Sublethal Effects for Semi-Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Great blue heron		
	PDE	RTV	HQ
1,2-Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00
1,4-Dichlorobenzene	0.0E+00	7.6E+02	0.0E+00
Benzo(b)fluoranthene	0.0E+00	1.0E+01	0.0E+00
Chrysene	1.4E-03	1.0E+01	1.4E-04
Naphthalene	0.0E+00	3.6E+01	0.0E+00
Benzene	0.0E+00	7.6E+02	0.0E+00
Carbon disulfide	3.6E-06	1.1E+01	3.3E-07
Chlorobenzene	0.0E+00	8.9E+01	0.0E+00
Chloroform	3.2E-06	1.6E+02	1.9E-08
Trichloroethylene	1.0E-05	4.8E+02	2.2E-08
Xylene	0.0E+00	5.0E+02	0.0E+00
SUMMARY HAZARD INDEX			1.8E+00

PDE = Potential Dietary Exposure (mg/kgBW-day). RTV = Reference Toxicity Value (mg/kgBW-day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O−2.22
Risk from Lethal or Sublethal Effects for Semi−Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Raccoon		
	PDE	RTV	HQ
Arsenic	6.9E−06	5.8E−01	1.2E−05
Barium	1.2E−05	2.0E+02	6.3E−08
Copper	3.8E−04	1.0E+02	3.8E−06
Lead	8.2E−06	2.5E+00	3.3E−06
Selenium	1.1E−07	2.0E−01	5.7E−07
Zinc	2.0E−05	2.0E+02	1.0E−07
4,4'−DDD	3.8E−07	1.2E+01	3.1E−08
Aroclor−1260	4.0E−06	7.5E−03	5.3E−04
Benzo[k]fluoranthene	1.1E−06	1.0E+01	1.1E−07
Fluoranthene	2.5E−06	1.0E+01	2.5E−07
Phenanthrene	1.4E−06	1.0E+01	1.4E−07
Pyrene	2.1E−06	1.0E+01	2.1E−07
Acetone	5.3E−07	6.0E+02	8.8E−10
Toluene	8.4E−08	7.6E+01	1.1E−09
1,2−Dichlorobenzene	1.5E−06	7.6E+02	1.9E−09
1,4−Dichlorobenzene	3.8E−06	7.6E+02	5.0E−09
Benzo(b)fluoranthene	1.8E−06	1.0E+01	1.8E−07
Chrysene	1.3E−06	1.0E+01	1.3E−07
Naphthalene	2.0E−06	3.6E+01	5.6E−08
Benzene	9.3E−08	7.6E+02	1.2E−10
Carbon disulfide	2.6E−08	1.1E+01	2.4E−09
Chlorobenzene	2.5E−07	8.9E+01	2.9E−09
Xylene	2.8E−08	5.0E+02	5.5E−11
Antimony	2.5E−07	4.2E+01	6.0E−09
SUMMARY HAZARD INDEX			5.5E−04

PDE = Potential Dietary Exposure (mg/kgBW−day). RTV = Reference Toxicity Value (mg/kgBW−day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

O-3 ECOLOGICAL RISK CALCULATIONS FOR CPCs SUPPORTING INFORMATION

TABLE O-3.1

CHEMICALS ELIMIMATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 2 UPLAND SURFACE SOIL[1]

AOC 57

REMEDIAL INVESTIGATION REPORT

DEVENS, MASSACHUSETTS

ANALYTE	Frequency of Detection[2]	Range of SQLs[3]	Range of Detected Concentrations	Background Surface Soil Concentrations[4]	Average of all Concentrations[5]	Exposure Point Concentrations	
						RME[6]	Average[7]
PAL METALS (µg/g)							
Aluminum	5/5	NA	3,920 to 7,530	18,000	6,700	7,530	6,700
Barium	5/5	NA	18.8 to 40.9	54	26.3	40.9	26.3
Beryllium	1/5	0.5	0.71	0.81	0.34	0.71	0.34
Chromium	5/5	NA	7.7 to 27	33	15.9	27.0	15.9
Lead	5/5	NA	8.1 to 22.9	48	14.0	22.9	14.0
Vanadium	5/5	NA	7.6 to 15.5	32.3	12.0	15.5	12.0
Zinc	5/5	NA	13.7 to 38.1	43.9	24.2	38.1	24.2

Notes:

1 Sample locations include: 57B-95-01X, 57B-95-02X, 57E-95-02X, 57E-95-10X, and 57E-95-25X (all collected from 0 to 2 feet below ground surface).

2 Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

3 Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

4 Inorganic background concentrations from the Ft. Devens background surface soil database (developed in 1993).

5 The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

6 Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calculated because there are fewer than 10 samples in the data set.

7 Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/g = micrograms per gram
AOC = Area of contamination.
CPC = Contaminant of potential concern.
NA = Not available.
PAL = Project analyte list.
RME = Reasonable maximum exposure.
SQL = Sample quantitation limit.

TABLE O-3.2
CHEMICALS ELIMIMATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 2 FLOODPLAIN SURFACE SOIL[1]
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

ANALYTE	Frequency of Detection[2]	Range of SQLs[3]	Range of Detected Concentrations	Background Surface Soil Concentration[4]	Average of all Concentrations[5]	Exposure Point Concentrations	
						RME[7]	Average[8]
PAL METALS (µg/g)							
Aluminum	3/3	NA	3,140 to 6,180	18,000	4,930	6,180	4,930
Beryllium	1/3	0.5	0.71	0.81	0.40	0.71	0.40
Chromium	3/3	NA	9.0 to 15.4	33	12.7	15.4	12.7
Cobalt	3/3	NA	1.9 to 2.3	4.7	2.1	2.3	2.1
Nickel	3/3	NA	6.1 to 10.4	14.6	7.9	10.4	7.9
Vanadium	3/3	NA	5.7 to 14	32.3	10.7	14	10.7

Notes:

[1] Sample locations include: 57E-95-12X, 57E-95-16X, and 57E-95-17X.

[2] Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

[3] Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

[4] Inorganic background concentrations from the Ft. Devens background surface soil database (developed in 1993).

[5] The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

[6] Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calculated because there were fewer than 10 samples in the dataset.

[7] Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/g = micrograms per gram
AOC = Area of contamination.
CPC = Contaminant of potential concern.
NA = Not available.
PAL = Project analyte list.
RME = Reasonable maximum exposure.
SQL = Sample quantitation limit.

TABLE O-3.3

CHEMICALS ELIMINATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 3 SURFACE SOIL[1]

AOC 57

ANALYTE	Frequency of Detection [2]	Range of SQLs [3]	Range of Detected Concentrations	Background Surface Soil Concentration [4]	Average of all Concentrations [5]	Exposure Point Concentrations	
						RME [6]	Average [7]
PAL METALS (µg/g)							
Aluminum	2/2	NA	6,370 to 7,100	18,000	6,740	7,100	6,740
Barium	4/4	NA	11.1 to 29.3	54	18.0	29.3	18.0
Chromium	2/2	NA	10.6 to 11.7	33	11.2	11.7	11.2
Cobalt	2/2	NA	2.4 to 3.2	4.7	2.8	3.2	2.8
Copper	4/4	NA	2.9 to 6.8	13.5	4.6	6.8	4.6
Lead	3/4	10.5	7.8 to 32.7	48	16.9	32.7	16.9
Nickel	2/2	NA	10.5 to 11.1	14.6	10.8	11.1	10.8
Vanadium	2/2	NA	9.2 to 9.4	32.3	9.3	9.4	9.3
Zinc	4/4	NA	15.8 to 28.5	43.9	22.1	28.5	22.1

Notes:

1 Sample locations include: 57B-96-08X, 57B-96-09X, 57S-98-13X, and 57S-98-14X.

2 Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

3 Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

4 Inorganic background concentrations from the Ft. Devens background surface soil database (developed in 1993).

5 The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

6 Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calculated because there are fewer than 10 samples in the data set.

7 Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/g = micrograms per gram
AOC = Area of contamination.
CPC = Contaminant of potential concern.
NA = Not available.
PAL = Project analyte list.
RME = Reasonable maximum exposure.
SQL = Sample quantitation limit.

TABLE O-3.4

CHEMICALS ELIMINATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 3 SURFACE WATER[1]

AOC 57

REMEDIAL INVESTIGATION REPORT

DEVENS, MASSACHUSETTS

ANALYTE	Frequency of Detection [2]	Range of SQLs [3]	Range of Detected Concentrations	Upgradient Surface Water Concentration [4]	Average of all Concentrations [5]	Exposure Point Concentrations	
						RME [6]	Average [7]
PAL UNFILTERED METALS (µg/L)							
Manganese	1/1	NA	92.8	131	92.8	92.8	92.8

Notes:

[1] Sample locations include: 57W-98-07X. Manganese data were rejected in 4 out of 5 surface water samples.

[2] Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

[3] Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

[4] The arithmetic mean of inorganic concentrations detected in upgradient samples 57W-95-03X and -08X.

[5] The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

[6] Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calculated because there are fewer than 10 samples in the data set.

[7] Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/L = micrograms per liter
AOC = Area of contamination.
CPC = Contaminant of potential concern.
NA = Not available.
PAL = Project analyte list.
RME = Reasonable maximum exposure.
SQL = Sample quantitation limit.

TABLE O-3.5

CHEMICALS ELIMINATED AS ECOLOGICAL CONTAMINATNS OF POTENTIAL CONCERN IN AREA 2 SEDIMENT[1]

AOC 57

REMEDIAL INVESTIGATION REPORT

DEVENS, MASSACHUSETTS

ANALYTE	Frequency of Detection[2]	Range of SQLs[3]	Range of Detected Concentrations	Upgradient Sediment Concentration[4]	Elevated Sediment Concentration[5]	Average of all Concentrations[6]	Exposure Point Concentrations	
							RME[7]	Average[8]
PAL METALS (µg/g)								
Cadmium	1/6	0.70	2.3	NA	5-14	0.68	2.3	0.68
Vanadium	4/6	3.4	28.4 to 40.3	34.7	60-100	22.9	40.3	22.9

Notes:

[1] Sample locations include: 57D-95-04X through 57D-95-07X, 57D-95-09X, and 57D-95-10X.

[2] Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

[3] Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

[4] The arithmetic mean of concentrations detected in upgradient samples 57D-95-03X and -08X.

[5] Rojko, 1990. "Proposed Classification Scheme for Sediments in Massachusetts Lakes and Ponds". Values less than the provided range are classified as "normal", and values greater than the provided range are classified as "highly elevated".

[6] The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

[7] Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calucated because there are fewer than 10 samples in the data set.

[8] Average Exposure Point Concentrations (EPCs) are equal to the lesser of the average of all concentrations and RME.

µg/g = micrograms per gram
AOC = Area of contamination.
CPC = Contaminant of potential concern.
NA = Not available.
PAL = Project analyte list.
RME = Reasonable maximum exposure.
SQL = Sample quantitation limit.

TABLE O-3.6
CHEMICALS ELIMINATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 3 SEDIMENT[1]
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

ANALYTE	Frequency of Detection[2]	Range of SQLs[3]	Range of Detected Concentrations	Upgradient Sediment Concentration[4]	Elevated Sediment Concentration[5]	Average of all Concentrations[6]	Exposure Point Concentrations	
							RME[7]	Average[8]
PAL METALS (µg/g)								
Arsenic	5/5	NA	3.2 to 37.1	110	25-50	20.0	37.1	20.0
Barium	5/5	NA	16.1 to 59.8	101	NA	33.0	59.8	33.0
Copper	3/5	0.97	2.7 to 11.2	30.7	70-130	4.0	11.2	4.0
Lead	2/5	10.5	33.6 to 64.6	208	200-410	22.8	64.6	22.8
Manganese	5/5	NA	29 to 459	1,510	350-850	188	459	188
Selenium	4/5	0.25	0.72 to 1.8	2.8	NA	1.1	1.8	1.1
Zinc	1/5	8.0	90.8	315	250-450	21.4	90.8	21.4

Notes:

1 Sample locations include: 57D-98-04X through 57D-98-08X.

2 Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

3 Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

4 The arithmetic mean of inorganic concentrations detected in upgradient samples 57D-95-03X and -08X.

5 Rojko, 1990. "Proposed Classification Scheme for Sediments in Massachusetts Lakes and Ponds". Values less than the provided range are classified as "normal", and values greater than the provided range are classified as "highly elevated".

6 The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

7 Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calucated because there are fewer than 10 samples in the data set.

8 Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/g = micrograms per gram
AOC = Area of contamination.
CPC = Contaminant of potential concern.
NA = Not available.
PAL = Project analyte list.
RME = Reasonable maximum exposure.
SQL = Sample quantitation limit.

TABLE O-3.7
RESULTS OF FOOD-WEB MODELING FOR
SURFACE SOIL, SEDIMENT, AND SURFACE WATER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Media Evaluated / Ecological Receptor	HIs for RME Concentrations of Chemicals Eliminated as CPCs [a]	HIs for RME Concentrations of CPCs [b]	Total Risk for CPCs and Chemicals Eliminated as CPCs
Area 2 Upland Surface Soil			
White-footed mouse	0.17	1.5	1.7
American robin	0.32	0.94	1.3
Red fox	0.000034	0.000077	0.00011
Barred owl	0.00011	0.00021	0.00032
Area 2 Floodplain Surface Soil			
White-footed mouse	0.096	4.0	4.1
Short-tailed shrew	0.20	2.4	2.6
American robin	0.17	1.8	2.0
Raccoon	0.00011	0.037	0.037
Barred owl	0.000039	0.00028	0.00032
Area 3 Surface Soil			
White-footed mouse	0.17	3.0	3.2
American robin	0.13	0.91	1.0
Red fox	0.000013	0.0011	0.0011
Barred owl	0.000037	0.00034	0.00038
Area 2 Sediment			
Muskrat	0.055	13	13
Mallard	0.000030	0.015	0.015
Raccoon	0.00015	0.028	0.028
Great blue heron	0.036	12	12
Area 3 Sediment and Unfiltered Surface Water			
Raccoon	0.00062	0.00064	0.0013

[a] The information listed is summarized from Tables O-4.1 through O-4.10 in Appendix O-4. These values are HIs calculated for all chemicals eliminated as CPCs in the baseline ERA.

[b] The information listed was obtained from Table 9-60. These values are HIs calculated for all chemicals retained as CPCs in the baseline ERA.

CPC = Chemical of Potential Concern
HI = Hazard Index
NA = Not applicable.
RME = Reasonable Maximum Exposure

TABLE O-3.8
SUMMARY OF ECOLOGICAL RISK FOR PLANTS AND INVERTEBRATES FROM CHEMICALS ELIMINATED AS CPCs IN AREA 2 UPLAND SURFACE SOIL
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Analyte	Exposure Point Concentrations [1]		RTV (µg/g)		RTV Exceeded? [3] (by RME / by Avg.)	
	RME	Average	Plant [2]	Invertebrate [2]	Plant	Invertebrate
PAL Metals (µg/g)						
Aluminum	7,530	6,700	50	NA	Yes/Yes	NA
Barium	40.9	26.3	500	NA	No/No	NA
Beryllium	0.71	0.34	10	NA	No/No	NA
Chromium	27.0	15.9	1	250	Yes/Yes	No/No
Lead	22.9	14.0	50	1,190	No/No	No/No
Vanadium	15.5	12.0	2	NA	Yes/Yes	NA
Zinc	38.1	24.2	50	130	No/No	No/No

1 Exposure Point Concentrations (EPCs) are presented in Table O-3.1.

2 Plant and invertebrate RTVs are presented in Appendix O-1, Tables O-1.7 and O-1.8 (respectively). Generally, the plant RTVs are the lowest LOEC from among plant growth studies on plants in solid media, and invertebrate RTVs are the lowest LC_{50} (14-day soil test on *Eisenia foetida*) from among chemicals in the same chemical class (applies to organic compounds). A conservative factor of 0.2 was applied to invertebrate RTVs; the resultant value should be protective of 99.9% of the population from lethal effects (USEPA, 1986).

3 Comparison shown is maximum EPC to RTV/average EPC to RTV.

RTV = reference toxicity value.
µg/g = micrograms per gram.
LC_{50} = concentration lethal to 50% of the test population.
LOEC = lowest observed effect concentration.
NA = Not available.
RME = Reasonable maximum exposure.
Shading indicates exceedances.

TABLE O-3.9
SUMMARY OF ECOLOGICAL RISK FOR PLANTS AND INVERTEBRATES FROM CHEMICALS ELIMINATED AS CPCs IN AREA 2 FLOODPLAIN SURFACE SOIL
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Analyte	Exposure Point Concentrations [1]		RTV (µg/g)		RTV Exceeded? [3] (by RME / by Avg.)	
	RME	Average	Plant [2]	Invertebrate [2]	Plant	Invertebrate
PAL Metals (µg/g)						
Aluminum	6,180	4,930	50	NA	Yes/Yes	NA
Beryllium	0.71	0.40	10	NA	No/No	NA
Chromium	15.4	12.7	1	250	Yes/Yes	No/No
Cobalt	2.3	2.1	20	NA	No/No	NA
Nickel	10.4	7.9	30	400	No/No	No/No
Vanadium	14	10.7	2	NA	Yes/Yes	NA

1 Exposure Point Concentrations (EPCs) are presented in Table O-3.2.

2 Plant and invertebrate RTVs are presented in Appendix O-1, Tables O-1.7 and O-1.8 (respectively). Generally, the plant RTVs are the lowest LOEC from among plant growth studies on plants in solid media, and invertebrate RTVs are the lowest LC_{50} (14-day soil test on *Eisenia foetida*) from among chemicals in the same chemical class (applies to organic compounds). A conservative factor of 0.2 was applied to invertebrate RTVs; the resultant value should be protective of 99.9% of the population from lethal effects (USEPA, 1986).

3 Comparison shown is maximum EPC to RTV/average EPC to RTV.

RTV = reference toxicity value.
µg/g = micrograms per gram.
LC_{50} = concentration lethal to 50% of the test population.
LOEC = lowest observed effect concentration.
NA = Not available.
RME = Reasonable maximum exposure.
Shading indicates exceedances.

TABLE O-3.10
SUMMARY OF ECOLOGICAL RISK FOR PLANTS AND INVERTEBRATES FROM CHEMICALS ELIMINATED AS CPCs IN AREA 3 SURFACE SOIL
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Analyte	Exposure Point Concentrations [1]		RTV (µg/g)		RTV Exceeded? [3] (by RME / by Avg.)	
	RME	Average	Plant [2]	Invertebrate [2]	Plant	Invertebrate
PAL Metals (µg/g)						
Aluminum	7,100	6,740	50	NA	Yes/Yes	NA
Barium	29.3	18.0	500	NA	No/No	NA
Chromium	11.7	11.2	1	250	Yes/Yes	No/No
Cobalt	3.2	2.8	20	NA	No/No	NA
Copper	6.8	4.6	100	30	No/No	No/No
Lead	32.7	16.9	50	1,190	No/No	No/No
Nickel	11.1	10.8	30	400	No/No	No/No
Vanadium	9.4	9.3	2	NA	Yes/Yes	NA
Zinc	28.5	22.1	50	130	No/No	No/No

1 Exposure Point Concentrations (EPCs) are presented in Table O-3.3.

2 Plant and invertebrate RTVs are presented in Appendix O-1, Tables O-1.7 and O-1.8 (respectively). Generally, the plant RTVs are the lowest LOEC from among plant growth studies on plants in solid media, and invertebrate RTVs are the lowest LC_{50} (14-day soil test on *Eisenia foetida*) from among chemicals in the same chemical class (applies to organic compounds). A conservative factor of 0.2 was applied to invertebrate RTVs; the resultant value should be protective of 99.9% of the population from lethal effects (USEPA, 1986).

3 Comparison shown is maximum EPC to RTV/average EPC to RTV.

RTV = reference toxicity value.
µg/g = micrograms per gram.
LC_{50} = concentration lethal to 50% of the test population.
LOEC = lowest observed effect concentration.
NA = Not available.
RME = Reasonable maximum exposure.
Shading indicates exceedances.

TABLE O-3.11
COMPARISON OF AREA 3 SURFACE WATER EXPOSURE CONCENTRATIONS FOR CHEMICALS ELIMINATED AS COCs WITH TOXICITY BENCHMARK VALUES [1]
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Analyte	Exposure Point Concentrations		AWQC [2] (µg/l)	AQUIRE Lowest Reported Adverse Effect Concentration [3] (µg/l) / Test Species	Result
	RME	Average			
PAL Unfiltered Metals (µg/l)					
Manganese	92.8	92.8	NA	280/phytoplankton population endpoints	Not exceeded

[1] Results of analyses of surface water samples are included in Section 7. Only those analytes selected as aquatic CPCs in Table O-3.4 are presented.
[2] Chronic Federal Ambient Water Quality Criteria (USEPA, 1991 and 1988).
[3] From Appendix O-1, Table O-1.9. Only growth, mortality, reproductive, and biomass effects to fish, plants, invertebrates, and amphibians were considered.

Notes:

CPC = contaminant of potential concern
µg/l = micrograms per liter
AWQC = Ambient Water Quality Criteria (guidance criteria established under the Clean Water Act)
NA = Not available

TABLE O-3.12
COMPARISON OF AREA 2 SEDIMENT EXPOSURE CONCENTRATIONS FOR CHEMICALS ELIMINATED AS CPCs
WITH TOXICITY BENCHMARK VALUES [1]
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Analyte	Exposure Point Concentrations		USEPA Sediment Quality Guidelines [2]	NOAA [3]		OME LEL [4]	NYSDEC LEL [5]	Result
	Maximum	Average		ER-L	ER-M			
PAL Metals (µg/g)								
Cadmium	2.3	0.68	NA	1.2	9.6	0.6	0.6	Exceeds benchmark
Vanadium	40.3	22.9	NA	NA	NA	NA	NA	No benchmark available

[1] Results of analyses of sediment samples are included in Section 7. Only those analytes selected as aquatic CPCs in Table O-3.5 are presented.
[2] U.S. Environmental Protection Agency (USEPA, 1988) mean Sediment Quality Criteria (SQCs).
[3] National Oceanic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L) and Effects Range-Median (ER-M) Sediment Guidelines correspond to the concentration that is protective of the 90th percentile and the 50th percentile of the test populations, respectively (Long et al., 1994).
[4] Ontario Ministry of the Environment (OME) Low Effects Level (LEL) Provincial Sediment Quality Guidelines (Persaud et al., 1996) correspond to a concentration that can be tolerated by the majority of benthic organisms.
[5] New York State Department of Environmental Conservation (NYSDEC) sediment criteria for evaluating chronic toxicity to benthic aquatic life (NYSDEC, 1994). The values presented for metals represent lowest effect levels (LELs).

Notes:
µg/g = micrograms per gram
NA = Not available

TABLE O-3.13
COMPARISON OF AREA 3 SEDIMENT EXPOSURE CONCENTRATIONS FOR CHEMICALS ELIMINATED AS CPCs WITH TOXICITY BENCHMARK VALUES [1]
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Analyte	Exposure Point Concentrations		USEPA Sediment Quality Guidelines [2]	NOAA [3]		OME LEL [4]	NYSDEC LEL [5]	Result
	Maximum	Average		ER-L	ER-M			
PAL Metals (µg/g)								
Arsenic	37.1	20.0	NA	8.2	70	6.0	6.0	Exceeded
Barium	59.8	33.0	NA	NA	NA	NA	NA	Exceeded [6]
Copper	11.2	4.0	NA	34	270	16	16	Not exceeded
Lead	64.6	22.8	NA	46.7	218	31	31	Exceeded
Manganese	459	188	NA	NA	NA	460	460	Not exceeded
Selenium	1.8	1.1	NA	NA	NA	NA	NA	No benchmark available
Zinc	90.8	21.4	NA	150	410	120	120	Not exceeded

1 Results of analyses of sediment samples are included in Section 7. Only those analytes selected as aquatic CPCs in Table O-3.6 are presented.
2 U.S. Environmental Protection Agency (USEPA, 1988) mean Sediment Quality Criteria (SQCs).
3 National Oceanic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L) and Effects Range-Median (ER-M) Sediment Guidelines correspond to the concentration that is protective of the 90th percentile and the 50th percentile of the test populations, respectively (Long et al., 1994).
4 Ontario Ministry of the Environment (OME) Low Effects Level (LEL) Provincial Sediment Quality Guidelines (Persaud et al., 1996) correspond to a concentration that can be tolerated by the majority of benthic organisms.
5 New York State Department of Environmental Conservation (NYSDEC) sediment criteria for evaluating chronic toxicity to benthic aquatic life (NYSDEC, 1994). The values for metals represent lowest effect levels (LELs).
6 A sediment guideline of 20 mg/kg (provided by U.S. EPA Region V for the pollution classification of Great Lakes Harbor sediment [Fitchko, 1989]) is exceeded by the RME and average barium concentrations. These concentrations for barium fall within the range of "heavily polluted" sediments.

Notes:
µg/g = micrograms per gram
NA = Not available

O-4 ECOLOGICAL RISK CALCULATIONS FOR NON-CPCs SUPPORTING INFORMATION

Table O-4.1
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA		ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS				BAF VALUES FOR OTHER FOOD ITEMS	
ANALYTE	RME CONCENTRATION (mg/kg)	Invert BAF[a]	Concentration in Invertebrate Tissue[b] (mg/kg)	Plant BAF[a]	Concentration in Plant Tissue[c] (mg/kg)	Small Mammal BAF[a]	Small Bird BAF[a]
Aluminum	7.5E+03	7.5E-02	5.6E+02	8.0E-04	6.0E+00	7.5E-02	7.5E-02
Barium	4.1E+01	7.5E-03	3.1E-01	3.0E-02	1.2E+00	7.5E-03	7.5E-03
Beryllium	7.1E-01	5.0E-02	3.5E-02	2.0E-03	1.4E-03	5.0E-02	5.0E-02
Chromium	2.7E+01	1.6E-01	4.3E+00	1.5E-03	4.1E-02	2.8E-01	2.8E-01
Lead	2.3E+01	7.8E-02	1.8E+00	9.0E-03	2.1E-01	1.5E-02	1.5E-02
Vanadium	1.6E+01	1.3E-01	2.0E+00	1.1E-03	1.7E-02	1.2E-01	1.2E-01
Zinc	3.8E+01	1.8E+00	6.9E+01	6.1E-01	2.3E+01	2.1E+00	2.1E+00

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–4.1
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	*White–footed mouse*	*American robin*	*Red fox*	*Barred owl*
Aluminum	2.6E+01	1.0E+02	5.2E–03	2.6E–02
Barium	2.4E–01	5.2E–01	2.1E–05	1.2E–04
Beryllium	2.3E–03	8.9E–03	4.4E–07	2.3E–06
Chromium	1.2E–01	4.4E–01	2.9E–05	1.4E–04
Lead	1.0E–01	3.2E–01	1.6E–05	7.1E–05
Vanadium	6.4E–02	2.4E–01	1.4E–05	6.0E–05
Zinc	3.4E+00	4.3E+00	8.5E–04	5.8E–03

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O-4.1
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

Representative Wildlife Species		Percent Prey in Diet: Inverts	Plants	Small Mammals	Small Birds	Soil	Home Range (acres)	ED [f]	Site Foraging Frequency [g]	Food Ingestion Rate (kg/day)	Body Weight (kg)
White-footed mouse	(Herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0049	0.040
American robin	(Omn. bird)	33%	57%	0%	0%	10%	0.48	0.75	1.00E+00	0.011	0.077
Red fox	(Predatory mammal)	20%	10%	57%	10%	3%	1,727	1	2.90E-04	0.24	4.69
Barred owl	(Predatory bird)	3%	0%	80%	12%	5%	565	1	8.85E-04	0.047	0.72

NOTES:

SITE AREA:	0.5 acres

[e] Documentation of exposure parameters presented in: Appendix O-1, Table O-1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-4.2
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA		ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS				BAF VALUES FOR OTHER FOOD ITEMS	
ANALYTE	RME CONCENTRATION (mg/kg)	Invert BAF [a]	Concentration in Invertebrate Tissue [b] (mg/kg)	Plant BAF [a]	Concentration in Plant Tissue [c] (mg/kg)	Small Mammal BAF [a]	Small Bird BAF [a]
Aluminum	6.2E+03	7.5E-02	4.6E+02	8.0E-04	4.9E+00	7.5E-02	7.5E-02
Beryllium	7.1E-01	5.0E-02	3.5E-02	2.0E-03	1.4E-03	5.0E-02	5.0E-02
Chromium	1.5E+01	1.6E-01	2.5E+00	1.5E-03	2.3E-02	2.8E-01	2.8E-01
Cobalt	2.3E+00	1.0E+00	2.3E+00	4.0E-03	9.2E-03	1.0E+00	1.0E+00
Nickel	1.0E+01	2.3E-01	2.4E+00	1.2E-02	1.2E-01	3.0E-01	3.0E-01
Vanadium	1.4E+01	1.3E-01	1.8E+00	1.1E-03	1.5E-02	1.2E-01	1.2E-01

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–4.2
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	*White–footed mouse*	*American robin*	*Raccoon*	*Barred owl*	*Short–tailed shrew*
Aluminum	2.1E+01	5.2E+01	2.6E−02	1.2E−02	4.3E+01
Beryllium	2.3E−03	5.6E−03	2.9E−06	1.3E−06	4.4E−03
Chromium	7.0E−02	1.6E−01	7.5E−05	3.7E−05	1.5E−01
Cobalt	3.5E−02	6.7E−02	2.6E−05	2.1E−05	8.9E−02
Nickel	6.8E−02	1.3E−01	5.8E−05	2.8E−05	1.3E−01
Vanadium	5.8E−02	1.3E−01	6.4E−05	2.9E−05	1.2E−01

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O-4.2
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

Representative Wildlife Species		Percent Prey in Diet: Inverts	Plants	Small Mammals	Small Birds	Soil	Home Range (acres)	ED [f]	Site Foraging Frequency [g]	Food Ingestion Rate (kg/day)	Body Weight (kg)
White-footed mouse	(Herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0049	0.040
American robin	(Omn. bird)	33%	57%	0%	0%	10%	0.48	0.75	6.25E-01	0.011	0.077
Raccoon	(Predatory mammal)	14%	56%	19%	2%	9%	385	1	7.79E-04	0.214	3.99
Barred owl	(Predatory bird)	3%	0%	80%	12%	5%	565	1	5.31E-04	0.047	0.72
Short-tailed shrew	(Omn. mammal)	78%	12%	0%	0%	10%	0.96	1	3.12E-01	0.0024	0.017

NOTES:

SITE AREA:	0.3 acres

[e] Documentation of exposure parameters presented in: Appendix O-1, Table O-1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-4.3
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA		ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS				BAF VALUES FOR OTHER FOOD ITEMS	
ANALYTE	RME CONCENTRATION (mg/kg)	Invert BAF[a]	Concentration in Invertebrate Tissue [b] (mg/kg)	Plant BAF[a]	Concentration in Plant Tissue [c] (mg/kg)	Small Mammal BAF[a]	Small Bird BAF[a]
Aluminum	7.1E+03	7.5E-02	5.3E+02	8.0E-04	5.7E+00	7.5E-02	7.5E-02
Barium	2.9E+01	7.5E-03	2.2E-01	3.0E-02	8.8E-01	7.5E-03	7.5E-03
Chromium	1.2E+01	1.6E-01	1.9E+00	1.5E-03	1.8E-02	2.8E-01	2.8E-01
Cobalt	3.2E+00	1.0E+00	3.2E+00	4.0E-03	1.3E-02	1.0E+00	1.0E+00
Copper	6.8E+00	1.6E-01	1.1E+00	7.8E-01	5.3E+00	6.0E-01	6.0E-01
Lead	3.3E+01	7.8E-02	2.6E+00	9.0E-03	2.9E-01	1.5E-02	1.5E-02
Nickel	1.1E+01	2.3E-01	2.6E+00	1.2E-02	1.3E-01	3.0E-01	3.0E-01
Vanadium	9.4E+00	1.3E-01	1.2E+00	1.1E-03	1.0E-02	1.2E-01	1.2E-01
Zinc	2.8E+01	1.8E+00	5.1E+01	6.1E-01	1.7E+01	2.1E+00	2.1E+00

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–4.3
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

ANALYTE	*White–footed mouse*	*American robin*	*Red fox*	*Barred owl*
Aluminum	2.5E+01	4.0E+01	2.0E–03	9.2E–03
Barium	1.7E–01	1.6E–01	6.0E–06	3.4E–05
Chromium	5.3E–02	8.0E–02	4.8E–06	2.0E–05
Cobalt	4.8E–02	6.2E–02	6.0E–06	2.1E–05
Copper	6.0E–01	1.8E–01	1.6E–05	7.7E–05
Lead	1.4E–01	1.9E–01	9.1E–06	4.0E–05
Nickel	7.3E–02	9.1E–02	5.8E–06	2.1E–05
Vanadium	3.9E–02	6.0E–02	3.3E–06	1.3E–05
Zinc	2.6E+00	1.3E+00	2.4E–04	1.2E–03

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O–4.3
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

Representative Wildlife Species		Percent Prey in Diet: Inverts	Plants	Small Mammals	Small Birds	Soil	Home Range (acres)	ED [f]	Site Foraging Frequency [g]	Food Ingestion Rate (kg/day)	Body Weight (kg)
White–footed mouse	(Herb. mammal)	10%	88%	0%	0%	2%	0.147	1	1.00E+00	0.0049	0.040
American robin	(Omn. bird)	33%	57%	0%	0%	10%	0.48	0.75	4.17E–01	0.011	0.077
Red fox	(Predatory mammal)	20%	10%	57%	10%	3%	1,727	1	1.16E–04	0.24	4.69
Barred owl	(Predatory bird)	3%	0%	80%	12%	5%	565	1	3.54E–04	0.047	0.72

NOTES:

SITE AREA:	0.2 acres

[e] Documentation of exposure parameters presented in: Appendix O–1, Table O–1.1
[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.
[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-4.4
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA

CHEMICAL	RME SEDIMENT CONCENTRATION (mg/kg)	RME UNFILT. SURFACE WATER CONCENTRATION (mg/L)
Cadmium	2.3E+00	Not a CPC
Vanadium	4.0E+01	Not a CPC

ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS

Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)	Heron Tissue Exposure (mg/kg)
NA	1.4E+00	3.2E+00	4.1E-01	3.2E+00	3.2E+00
NA	1.3E-01	5.2E+00	1.1E-03	5.2E+00	5.2E+00

[a] Bioaccumulation data presented in: Appendix O, Tables O-1.2 and O-1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.
[b] Measured crayfish and fish tissue concentrations (provided in Table O-1.3).

Table O-4.4
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]

CHEMICAL	*Muskrat*	*Mallard*	*Raccoon*	*Great blue heron*
Cadmium	8.6E-02	1.6E-04	3.1E-04	1.3E-01
Vanadium	3.0E-01	1.5E-04	8.2E-04	2.5E-01

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9-27).

Table O-4.4
Exposure Parameters and Assumptions for Semi-Aquatic Receptors
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE PARAMETERS [d]

Indicator Species		Percent Prey in Diet: Aquatic Organisms	Percent Prey in Diet: Plants	Sediment	Home Range (acres)	ED [e]	Site Foraging Frequency [f]	Dietary Ingestion Rate (kg/day)	Water Ingestion Rate (L/day)	Body Weight (kg)
Muskrat	(Small herb. mammal)	10%	80%	10%	0.2	1	1.00E+00	0.084	0.12	1.27
Mallard	(Small herb. bird)	1%	97%	2%	235	1	2.98E-03	0.063	0.064	1.134
Raccoon	(Predatory mammal)	91%	0%	9%	385	1	1.82E-03	0.214	0.344	3.99
Great blue heron	(Piscivorous bird)	98%	0%	2%	1.5	0.5	4.67E-01	0.401	0.101	2.23

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O-1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

SITE AREA:	0.7 acres

Table O-4.5
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food, Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA			ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS				
CHEMICAL	RME SEDIMENT CONCENTRATION (mg/kg)	RME UNFILT. SURFACE WATER CONCENTRATION (mg/L)	Aquatic Organism BCF [a]	Aquatic Organism BAF [a]	Aq. Org. Tissue Level (mg/kg)	Aquatic Plant BAF [a]	Raccoon Tissue Exposure (mg/kg)
Arsenic	3.7E+01	Not a CPC	NA	6.6E-03	2.4E-01	3.0E-01	2.4E-01
Barium	6.0E+01	Not a CPC	NA	7.5E-03	4.5E-01	2.5E-02	4.5E-01
Copper	1.1E+01	Not a CPC	NA	1.6E-01	1.8E+00	6.0E-02	1.8E+00
Lead	6.5E+01	Not a CPC	NA	7.8E-02	5.0E+00	5.6E-02	5.0E+00
Manganese	4.6E+02	9.3E-02	1.7E+03	2.0E-02	1.6E+02	1.3E-01	1.6E+02
Selenium	1.8E+00	Not a CPC	NA	7.6E-01	1.4E+00	1.6E-01	1.4E+00
Zinc	9.1E+01	Not a CPC	NA	1.8E+00	1.6E+02	9.2E-01	1.6E+02

[a] Bioaccumulation data presented in: Appendix O, Tables O-1.2 and O-1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.
[b] Measured crayfish and fish tissue concentrations (provided in Table O-1.3).

Table O–4.5
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food, Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]

CHEMICAL	*Raccoon*
Arsenic	9.9E–05
Barium	1.6E–04
Copper	7.4E–05
Lead	2.9E–04
Manganese	5.2E–03
Selenium	3.9E–05
Zinc	4.4E–03

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9–27).

Table O–4.5
Exposure Parameters and Assumptions for Semi–Aquatic Receptors
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE PARAMETERS [d]

Indicator Species		Percent Prey in Diet: Aquatic Organisms	Percent Prey in Diet: Plants	Percent Prey in Diet: Sediment	Home Range (acres)	ED [e]	Site Foraging Frequency [f]	Dietary Ingestion Rate (kg/day)	Water Ingestion Rate (L/day)	Body Weight (kg)
Raccoon	(Predatory mammal)	91%	0%	9%	385	1	5.19E–04	0.214	0.344	3.99

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O–1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

SITE AREA:	0.2 acres

Table O–4.6
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	White–footed mouse			American robin			Red fox		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Aluminum	2.6E+01	4.3E+02	6.1E–02	1.0E+02	4.3E+02	2.4E–01	5.2E–03	4.3E+02	1.2E–05
Barium	2.4E–01	2.0E+02	1.2E–03	5.2E–01	2.0E+02	2.6E–03	2.1E–05	2.0E+02	1.1E–07
Beryllium	2.3E–03	8.5E–01	2.7E–03	8.9E–03	8.5E–01	1.1E–02	4.4E–07	8.5E–01	5.1E–07
Chromium	1.2E–01	3.5E+00	3.5E–02	4.4E–01	2.5E+01	1.8E–02	2.9E–05	3.5E+00	8.2E–06
Lead	1.0E–01	2.5E+00	4.0E–02	3.2E–01	7.5E+01	4.3E–03	1.6E–05	2.5E+00	6.4E–06
Vanadium	6.4E–02	6.0E+00	1.1E–02	2.4E–01	1.1E+01	2.2E–02	1.4E–05	6.0E+00	2.3E–06
Zinc	3.4E+00	2.0E+02	1.7E–02	4.3E+00	2.0E+02	2.1E–02	8.5E–04	2.0E+02	4.2E–06
SUMMARY HAZARD INDEX			1.7E–01			3.2E–01			3.4E–05

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.6
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	*Barred owl* PDE	RTV	HQ
Aluminum	2.6E–02	4.3E+02	6.1E–05
Barium	1.2E–04	2.0E+02	6.1E–07
Beryllium	2.3E–06	8.5E–01	2.7E–06
Chromium	1.4E–04	2.5E+01	5.5E–06
Lead	7.1E–05	7.5E+01	9.5E–07
Vanadium	6.0E–05	1.1E+01	5.5E–06
Zinc	5.8E–03	2.0E+02	2.9E–05
SUMMARY HAZARD INDEX			1.1E–04

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.7
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	White–footed mouse			American robin			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Aluminum	2.1E+01	4.3E+02	5.0E–02	5.2E+01	4.3E+02	1.2E–01	2.6E–02	4.3E+02	6.2E–05
Beryllium	2.3E–03	8.5E–01	2.7E–03	5.6E–03	8.5E–01	6.6E–03	2.9E–06	8.5E–01	3.4E–06
Chromium	7.0E–02	3.5E+00	2.0E–02	1.6E–01	2.5E+01	6.3E–03	7.5E–05	3.5E+00	2.1E–05
Cobalt	3.5E–02	4.2E+00	8.3E–03	6.7E–02	4.2E+00	1.6E–02	2.6E–05	4.2E+00	6.3E–06
Nickel	6.8E–02	1.3E+01	5.2E–03	1.3E–01	5.0E+01	2.5E–03	5.8E–05	1.3E+01	4.5E–06
Vanadium	5.8E–02	6.0E+00	9.7E–03	1.3E–01	1.1E+01	1.2E–02	6.4E–05	6.0E+00	1.1E–05
SUMMARY HAZARD INDEX			9.6E–02			1.7E–01			1.1E–04

PDE = Potential Dietary Exposure (mg/kgBW/day)　RTV = Reference Toxicity Value (mg/kgBW/day)　HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-4.7
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	Barred owl			Short-tailed shrew		
	PDE	RTV	HQ	PDE	RTV	HQ
Aluminum	1.2E-02	4.3E+02	2.8E-05	4.3E+01	4.3E+02	1.0E-01
Beryllium	1.3E-06	8.5E-01	1.5E-06	4.4E-03	8.5E-01	5.1E-03
Chromium	3.7E-05	2.5E+01	1.5E-06	1.5E-01	3.5E+00	4.4E-02
Cobalt	2.1E-05	4.2E+00	5.0E-06	8.9E-02	4.2E+00	2.1E-02
Nickel	2.8E-05	5.0E+01	5.5E-07	1.3E-01	1.3E+01	9.9E-03
Vanadium	2.9E-05	1.1E+01	2.6E-06	1.2E-01	6.0E+00	2.1E-02
SUMMARY HAZARD INDEX			3.9E-05			2.0E-01

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing P

Table O–4.8
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	White–footed mouse			American robin			Red fox		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Aluminum	2.5E+01	4.3E+02	5.8E–02	4.0E+01	4.3E+02	9.3E–02	2.0E–03	4.3E+02	4.6E–06
Barium	1.7E–01	2.0E+02	8.5E–04	1.6E–01	2.0E+02	7.9E–04	6.0E–06	2.0E+02	3.0E–08
Chromium	5.3E–02	3.5E+00	1.5E–02	8.0E–02	2.5E+01	3.2E–03	4.8E–06	3.5E+00	1.4E–06
Cobalt	4.8E–02	4.2E+00	1.2E–02	6.2E–02	4.2E+00	1.5E–02	6.0E–06	4.2E+00	1.4E–06
Copper	6.0E–01	1.0E+02	6.0E–03	1.8E–01	1.0E+02	1.8E–03	1.6E–05	1.0E+02	1.6E–07
Lead	1.4E–01	2.5E+00	5.7E–02	1.9E–01	7.5E+01	2.5E–03	9.1E–06	2.5E+00	3.6E–06
Nickel	7.3E–02	1.3E+01	5.6E–03	9.1E–02	5.0E+01	1.8E–03	5.8E–06	1.3E+01	4.5E–07
Vanadium	3.9E–02	6.0E+00	6.5E–03	6.0E–02	1.1E+01	5.5E–03	3.3E–06	6.0E+00	5.5E–07
Zinc	2.6E+00	2.0E+02	1.3E–02	1.3E+00	2.0E+02	6.6E–03	2.4E–04	2.0E+02	1.2E–06
SUMMARY HAZARD INDEX			1.7E–01			1.3E–01			1.3E–05

PDE = Potential Dietary Exposure (mg/kgBW/day)   RTV = Reference Toxicity Value (mg/kgBW/day)   HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.8
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

ANALYTE	Barred owl		
	PDE	RTV	HQ
Aluminum	9.2E–03	4.3E+02	2.2E–05
Barium	3.4E–05	2.0E+02	1.7E–07
Chromium	2.0E–05	2.5E+01	7.9E–07
Cobalt	2.1E–05	4.2E+00	5.1E–06
Copper	7.7E–05	1.0E+02	7.7E–07
Lead	4.0E–05	7.5E+01	5.4E–07
Nickel	2.1E–05	5.0E+01	4.3E–07
Vanadium	1.3E–05	1.1E+01	1.2E–06
Zinc	1.2E–03	2.0E+02	6.2E–06
SUMMARY HAZARD INDEX			3.7E–05

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.9
Risk of Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Muskrat			Mallard			Raccoon		
	PDE	RTV	HQ	PDE	RTV	HQ	PDE	RTV	HQ
Cadmium	8.6E–02	2.2E+01	4.0E–03	1.6E–04	1.0E+01	1.6E–05	3.1E–04	2.2E+01	1.4E–05
Vanadium	3.0E–01	6.0E+00	5.1E–02	1.5E–04	1.1E+01	1.4E–05	8.2E–04	6.0E+00	1.4E–04
SUMMARY HAZARD INDEX			5.5E–02			3.0E–05			1.5E–04

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.9
Risk of Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Great blue heron		
	PDE	RTV	HQ
Cadmium	1.3E–01	1.0E+01	1.3E–02
Vanadium	2.5E–01	1.1E+01	2.3E–02
SUMMARY HAZARD INDEX			3.6E–02

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-4.10
Risk of Lethal or Sublethal Effects for Semi-Aquatic Receptors from RME Concentrations of CPCs in Food, Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

CHEMICAL	Raccoon		
	PDE	RTV	HQ
Arsenic	9.9E-05	5.8E-01	1.7E-04
Barium	1.6E-04	2.0E+02	8.1E-07
Copper	7.4E-05	1.0E+02	7.4E-07
Lead	2.9E-04	2.5E+00	1.2E-04
Manganese	5.2E-03	4.5E+01	1.1E-04
Selenium	3.9E-05	2.0E-01	2.0E-04
Zinc	4.4E-03	2.0E+02	2.2E-05
SUMMARY HAZARD INDEX			6.2E-04

PDE = Potential Dietary Exposure (mg/kgBW-day). RTV = Reference Toxicity Value (mg/kgBW-day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

O-5 STATISTICAL ANALYSIS OF TOXICITY TESTING (MIDGE GROWTH)

Table O-5.1
Midge Growth - Copper

Location	X	Y
57D-95-04X	201	1.36
57D-95-05X	33.8	2
57D-95-06X	42.3	1.8
57D-95-07X	36.1	2.27
57D-95-08X	33.4	1.81
57D-95-10X	34.2	1.75

Regression Output:

Constant		2.0496496
Std Err of Y Est		0.2137037
R Squared		0.595026
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	-0.003435	
Std Err of Coef.	0.0014167	

CU_MGRO

Table O-5.2
Midge Growth - Lead

Location	X	Y
57D-95-04X	410	1.36
57D-95-05X	188	2
57D-95-06X	281	1.8
57D-95-07X	170	2.27
57D-95-08X	223	1.81
57D-95-10X	170	1.75

Regression Output:

Constant		2.4679626
Std Err of Y Est		0.1917392
R Squared		0.6739945
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	-0.002648	
Std Err of Coef.	0.0009207	

PB_MGRO

Table O-5.3
Midge Growth - TPH Diesel Fraction

Location	X	Y
57D-95-04X	169	1.36
57D-95-05X	52.5	2
57D-95-06X	62.1	1.8
57D-95-07X	114	2.27
57D-95-08X	51.4	1.81
57D-95-10X	4	1.75

Regression Output:

Constant		1.9420641
Std Err of Y Est		0.3223102
R Squared		0.0788058
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	-0.001462	
Std Err of Coef.	0.0024996	

ECOLOGICAL SURVEY

APPENDIX P

STUDY AREA AOC 57
ECOLOGICAL SURVEY

Baseline Ecological Risk Assessment
Fort Devens, Massachusetts

INTRODUCTION:

The following is a summary of the Ecological survey of the terrestrial and wetland habitats associated with AOC 57, which took place on October 13, 1995. The terrestrial and wetland habitats along Cold Spring Brook were characterized into major habitat types, through the qualitative analysis of plant species, microtopography, and hydrology. Individual site descriptions and plant species lists are provided below.

SITE DESCRIPTION

A qualitative line transect survey was utilized to characterize the upland and wetland habitats associated with the AOC 57 along Cold Spring Brook. Three transects were established perpendicular to a base line running in an east-north easterly direction along Cold Spring Brook. The following descriptions of each habitat encountered along the transects progress from the south side of the brook to the north side of the brook.

Transect 1:
Transect 1 was established perpendicular to the stream channel, approximately 300 feet to the southwest (upstream) of the AOC 57 containment berm.

Habitat A:
The first habitat encountered was a well established upland forest, co-dominated by white pines (*Pinus strobus*) and white and red oaks (*Quercus alba* and *rubra*). The canopy was approximately 60 feet high, with 85 percent aerial coverage. The shrub subcanopy was open, with sparse beech (*Fagus grandifolia*) and white pine saplings, intermixed with an 80/20 mix of lowbush and highbush blueberry shrubs (*Vaccinium corymbosum* and *angustifolium*). Other saplings present in this habitat included sparse red and white oak saplings. The herbaceous species that dominated this habitat included gold thread (*Coptis groenlandica*). Also common along the downslope transitional area between this habitat and habitat B were, partridge berry (*Mitchella repens*), interrupted fern (*Osmunda claytoniana*), cinnamon fern (*Osmunda cinnamomea*), and lady fern (*Athyrium filix-femina*). Additionally, the ground was covered with a mat of pine needles and semi-decomposed oak leaves. The ground surface slopes steeply towards the brook at approximately a 45 degree angle. Due to the steep slope and elevation above the brook (approximately 20 feet), surface water would never be present in this habitat.

Habitat B:
The next habitat encountered along transect 1, was a scrub/shrub marsh, approximately 30 feet wide. Trees in this habitat included a few red maples (*Acer rubrum*) and white pines, with red maple being the more dominant. The trees ranged from 30 to 45 feet tall, and the canopy was

largely open. This area also contained sparse standing dead trees. The shrubs in this area included arrow-wood (*Viburnum recognitum*), highbush blueberry (*Vaccinium corymbosum*), sweet gale (*Myrica gale*), winterberry (*Ilex verticillata*), sheep laurel (*Kalmia angustifolium*), speckled alder (*Alnus rugosa*), and red choke cherry (*Prunus virginiana*). Highbush blueberry and winterberry shared dominance in this habitat. The dominant herbaceous species present in this habitat included cinnamon fern, tussock sedge (*Carex stricta*), and sphagnum (*Sphagnum palustre*). Other herbaceous species included turtle head (*Chelone glabra*), aster (*Aster novi-belgii*), New York aster (*Aster novi-belhii*), and bedstraw (*Galium asprellum*). The presence of sphagnum moss (*Sphagnum palustre*), and the distinct mound and pool microtopography in this habitat indicate the water table would be at or near the ground surface throughout the year.

Habitat C:
The next habitat encountered on this transect was an emergent marsh, approximately 60 feet wide dominated by broad-leaved cattail (*Typha latifolia*). A prominent feature of this habitat was the presence of several (est. 5 per 0.25 acre) white pine snags, which were flooded when the containment berm was constructed. This habitat included the following shrubs, speckled alder, common alder (*Sambucus canadensis*), swamp rose (*Rosa palustris*), and arrow-wood. The herbaceous layer of this habitat was dominated by tussock sedge, umbrella sedge (*Cyperus* sp.), arrow-leaved tearthumb (*Polygonum sagittatum)*, jewelweed (*Impatiens capensis*), cinnamon fern, and sensitive fern (*Onoclea sensibilis*). The presence of sphagnum moss, and the mound and pool microtopography indicate a high water table (at or near the ground surface throughout the year). This habitat is bordered by the meandering stream channel.

Habitat D:
The last habitat encountered along transect 1 was a white pine (P. strobus) dominated floodplain forest with intermixed oaks (*Quercus* spp.) and maples (*Acer* spp). This habitat is bordered by the meandering stream channel. Vegetation along the stream fringe consists of tussock sedge and various ferns (*Dryopteris* and *Osmunda* spp.). The shrub layer in this habitat is dominated by arrow-wood, and subordinate shrub species present in this habitat include highbush blueberry, sheep laurel, red-osier dogwood (*Cornus stolonifera*), and winterberry.

Transect 2:
Transect 2 is perpendicular to the stream channel, running over the AOC 57 containment berm.

Habitat A:
The first habitat encountered along this transect is a well developed upland forest, co-dominated by white pines, white oaks, and red oaks. The canopy was approximately 60 feet high, with 80 to 85 percent aerial coverage. The shrub canopy is open, and includes low- and highbush blueberry, sheep laurel, clubmoss (*Lycopodium* sp.). The herbaceous layer is consistent with transect 1 and 3, scattered with interrupted fern (*Osmunda claytoniana*), cinnamon fern, lady fern, and gold thread. A large percentage of the ground surface in this habitat is covered with a mat of pine needles and partially decomposed oak leaves. The ground surface is sloping towards the steam at approximately a 30 degree angle. The water table in this habitat is well below the ground surface.

Habitat B:
The next habitat encountered along transect 2, was a scrub shrub marsh, approximately 12 to 15 feet wide. Trees in this habitat included white pines grading into red maples. This habitat also included a few scattered wind-throws. The scrub shrub layer consisted mostly of white pine saplings and fetterbush *(Leucothoe racemosa)*. The herbaceous layer was dominated by tussock sedge and sphagnum. Subordinate herbaceous species included interrupted fern, gold thread, aster (*Aster novae-angliae*), goldenrods (*Solidago* sp.), turtle head, and purple loosestrife (*Lythrum salicaria*). The ground surface transitioned from relatively flat to slightly mounded and pooled. This habitat seems to be hydrologically affected by the berm, as this area seemed wetter in comparison to the other similar habitats along transects 1 and 3. At the time of the site visit the water table was at the ground surface.

Habitat C:
The next habitat encountered along this transect was a broad-leaved cattail-dominated emergent marsh, approximately 10 to 15 feet wide. This habitat ends abruptly at the stream channel, (4 to 6 feet wide) which is bordered on the opposite side by the containment berm. The shrub layer consisted of an even distribution of arrow-wood, sweet gale, winterberry, red-osier dogwood, swamp birch *(Betula pumila)*, and swamp rose. Subordinate herbaceous species included tussock sedge, meadow rue (*Thalictrum polygamum*), marsh bedstraw (*Galium palustre*), aster, purple-leaved willow herb (*Epilobium coloratum*), and joe-pye weed (*Eupatorium dubium*). This habitat was distinctly mounded and pooled, and the water table was at the ground surface.

Habitat D:
The next habitat along transect 2 was the AOC 57 containment berm, which is approximately 30 feet wide and 150 feet long. The crest of the berm is approximately 2 feet above the ponded water surface in front of the berm. This habitat is mostly vegetated with shrubs and saplings. The dominant shrub in this habitat is speckled alder, and subordinate shrubs include highbush blueberry, arrow-wood, fetterbush, dogwood, silverberry (*Elaeagnus commutata*), and swamp rose.

Transect 3:
Transect 3 is perpendicular to the stream channel, approximately 300 feet to the northeast (downstream) of the SA57 containment berm.

Habitat A:
The first habitat encountered along transect 3 was a well established upland forest, co-dominated by white pines, white oak, and red oak. The canopy was approximately 60 feet high, with 80 to 85 percent aerial coverage. The shrub sublayer was intermixed with white pine saplings, low- and highbush blueberry, sheep laurel, witch hazel (*Hamamelis virginiana*), nannyberry (*Viburnum lentago*), and choke cherry. The shrub layer was co-dominated by low- and highbush blueberry, of which there was approximately a 75/25 mix. The herbaceous layer within this habitat was dominated by clubmoss (*Lycopodium carolinianum*), and ferns (*Thelipteris* sp.). The ground was sloping at approximately a 15 degree angle, progressively less than transect 1 and 2. The water table in this habitat is well below the ground surface.

Habitat B: The next habitat encountered along transect 3 was a forested wetland, approximately 35 to 45 feet wide. Red maple trees, approximately 25 to 30 feet high are

sparsely scattered throughout this habitat. The shrub layer is dominated by winterberry. Other shrubs common in this habitat included maleberry *(Lyonia ligustrina)*, paper birch (*Betula papyrifera*), speckled alder, and highbush blueberry. Herbaceous species common in this habitat included tussock sedge (*Carex stricta*), interrupted fern, water-smartweed (*Polygonum* sp.), turtle head, aster, and sphagnum. The ground surface transitioned from slight to distinct mound and pool microtopography, moving from the edge of habitat A towards the stream channel. This habitat may be seasonally flooded and saturated due to the close proximity of the stream channel. At the time of the survey the water table was just below the ground surface.

Habitat C:
The next habitat encountered along transect 3 was a scrub shrub swamp, approximately 250 feet wide. This habitat contained sparsely scattered white pine snags and red maple saplings. The shrub layer was dominated by sweet gale; less dominant species included arrow-wood, winterberry, swamp rose, nannyberry, alder, red-osier dogwood, and highbush blueberry. The herbaceous layer was co-dominated by reed canary grass (*Phalaris arundinacea*) along the stream channel and open areas, and tussock sedge below the shrub layer. Subordinate herbaceous plant species include arrowhead (*Sagitaria latifolia*), yellow pond-lily (*Nuphar variegatum*), pickerelweed (*Peltandra virginica*), duckweed (*Lemna minor*), and bur-reed (*Sparganium* sp.). The stream channel becomes indistinguishable in this habitat. A dendritic flow pattern is formed by water flowing around the mounded areas that are created by shrub, sedge, and grass growth. This habitat is characterized as a large flood plain, with the water at or near the ground surface throughout the year. While conducting the ecological survey, two adult winged odonates were observed in this habitat.

Habitat D:
The final habitat encountered alone transect 3 was forest wetland, approximately 150 feet wide. The wetland was dominated by white pines which had a canopy cover of approximately 50 to 60 percent. Red maple, bigtooth aspen (*Populus grandidentata*), and oak trees were also present in this habitat. The shrub layer in this habitat contained sparsely scattered white pine saplings, nannyberry, choke cherry, arrow-wood, white oak, highbush blueberry, red-osier dogwood, and sheep laurel. The herbaceous layer in this habitat is co-dominated by tussock sedge, clubmoss, and gold thread.

SEDIMENT TOXICITY EVALUATION

TOXICITY EVALUATION OF SEDIMENT COLLECTED FROM SITES AT FORT DEVENS, MASSACHUSETTS

ABB Environmental Services, Inc.
Corporate Place 128
107 Audubon Road
Wakefield, MA 01880

SLI Report # 96-3-6419
SLI Study # 13109-925-6131/6132/6133

PROGRAM MANAGER : Ronald C. Biever
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Springborn Laboratories, Inc.
Environmental Sciences Division
790 Main Street
Wareham, Massachusetts 02571

January 10, 1997

FINAL REPORT

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1.0 INTRODUCTION

Decisions regarding the need for remediation and efficacy, of remedial alternatives at sites containing waste materials, often depend on information concerning the environmental risks posed by conditions at the site. As part of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), remedial alternatives or removal actions for hazardous waste sites should include an environmental impact study. An essential part of the environmental impact study is the assessment of the degree and spatial extent of contamination in sediments and/or soils at the site.

In recognition of these concerns, ABB Environmental Services, Inc. in Wakefield, Massachusetts included a battery of screening evaluation assays with benthic organisms as a part of the environmental impact study. The toxicity of the bulk sediment samples was measured using epibenthic and benthic organisms, *Hyalella azteca* and *Chironomus tentans*, respectively. The bioaccumulation of xenobiotics in the sediments were measured using, a freshwater oligochaete, *Lumbriculus variegatus*.

The objective of this testing program was to evaluate the toxicity of contaminated bulk sediments from nine sites at Fort Devens, Massachusetts and to evaluate the bioaccumulation of xenobiotics from three of the nine sites at Fort Devens. All biological testing was conducted at Springborn Laboratories, Inc., Wareham, Massachusetts. The oligochaete tissue samples were analyzed by ESE Inc., Gainsville, Florida. All original raw data from the biological testing and the final report produced during this study are stored at Springborn.

2.0 MATERIALS AND METHODS

2.1 Test Samples

The toxicity tests were conducted using sediment collected from Fort Devens, Massachusetts. Approximately 4 liters of sediment from each location were collected by ABB

Environmental Services, Inc. personnel, with an additional 8 liters of sediment collected from the three sites for the bioaccumulation exposure. The nine samples were identified as: ZWD-95-02X, ZWD-95-03X, ZWD-95-06X, 57D-95-04X, 57D-95-05X, 57D-95-06X, 57D-95-07X, 57D-95-08X, and 57D-95-10X. The samples were received at Springborn on 15 September 1995. Three of the six sample containers for sample 57D-95-06X had lost their lids during shipping and sample 57D-95-04X was not included in this shipment. These two samples were recollected by ABB Environmental Services and they were received on 20 September 1995 in tact. Following receipt at Springborn, any samples that were not immediately tested were stored refrigerated at approximately 4 ± 2°C. Refrigerated samples were warmed to room temperature before use in the toxicity tests. Prior to use in the toxicity test, all sediment samples were passed through a 2.0 mm stainless steel sieve to remove rocks, debris and large clumps of sediment. In addition, Springborn collected sediment from Strobs Folly Brook, Wareham, MA which was used as a reference control sediment.

2.2 Overlying Water

Laboratory water was used for the overlying water and culture water for the midge, *Chironomus tentans*. The laboratory water was well water which had been supplemented with untreated water from the Town of Wareham, Massachusetts. The laboratory water had a total hardness of 30 mg/L as $CaCO_3$, a pH range of 7.0 to 7.2, and a specific conductivity within the range of 110 to 130 µmhos/cm.

The laboratory water was fortified to a total hardness of 160 to 180 mg/L as $CaCO_3$; alkalinity 110 to 130 mg/L as $CaCO_3$; specific conductance of 400 to 600 µmhos/cm; and a pH of 7.9 to 8.3 for the overlying water and culture water for the amphipod, *Hyalella azteca* (U.S. EPA, 1975).

2.3 Monitoring Environmental Conditions of the Test Systems

Dissolved oxygen concentrations were measured using a Yellow Springs Instrument (YSI) Model #57 dissolved oxygen meter and probe; pH was measured with a Jenco Model

601A pH meter and combination electrode; and daily temperature was measured with a Fisher alcohol thermometer. Total hardness concentration was measured by the EDTA titrimetric method. Total alkalinity concentration was determined by potentiometric titration to an endpoint of pH 4.5 (APHA *et. al.*, 1985). Specific conductance was measured using a YSI Model #33 conductivity meter. The temperature of the test solutions was continuously monitored throughout the study using a Fisher Min/Max thermometer. Light intensity was measured with a General Electric type 217 light meter.

2.4 Subchronic Toxicity Test with Midges

2.4.1 Test Method and Conduct

Test organisms were placed in beakers containing the sediment and clean laboratory overlying water on 25 September 1995 and were incubated under standard conditions until 5 October 1995 (10 days). After the exposure, the surviving organisms were counted and weighed. Sediment toxicity was estimated by comparing the response of exposed organisms in the test sediment with the reference sediment. Procedures used in the subchronic toxicity test with midge followed those described in the Springborn test method entitled "Static-Renewal Partial Life-Cycle Toxicity Test with Midge *Chironomus tentans*" to Meet U.S. EPA Guidelines, Springborn Laboratories Test Method #SED-Ct-101. The procedures described in this test method meet the standard procedures described in the *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (U.S. EPA, 1994). A copy of the test method is an attachment to this report.

2.4.2 Test Organism

Chironomus tentans were obtained from cultures maintained at Springborn. The culture system was maintained under static conditions and consisted of 38-liter glass aquaria, which contained approximately 20 L of laboratory well water, and were maintained at a temperature of 23 ± 2 °C. The culture area received a regulated photoperiod of 16 hours of light and 8 hours of darkness. Light at an intensity of 30 to 100 footcandles was provided at the culture solutions' surface by Durotest Vitalite® fluorescent bulbs. The midge cultures

were fed a combination of finely ground flaked fish food suspension (60 mg/mL) prepared at Springborn.

Midge egg masses were obtained from culture vessels by aspirating several adult male and females flies into a 250 mL flask approximately 12 to 14 days prior to test initiation. Egg masses deposited overnight, were removed and placed in a shallow glass pan with laboratory well water. Egg masses hatch occurs approximately 2 to 3 days after deposition. Larvae were fed a flaked fish food suspension (60 mg/mL) and overlying waster was replaced daily. test organisms, 9 to 11 days old (post hatch), were used to initiate the sediment exposures.

2.4.3 Test Procedures

Eight replicate test vessels (300-mL glass beakers) were maintained for each sediment sample and control. Each vessel contained 100 mL (wet weight) of sediment and 175 mL of laboratory water. The resultant sediment layer in each test vessel was 2 cm deep. Each sediment was tested as 100% with no dilutions. The test systems with sediment and water were allowed to sit overnight before introducing the test organisms. The test was initiated when ten midge larvae were introduced to each test vessel. Aeration was provided to each test vessel when dissolved oxygen dropped below 40% of saturation.

The test was conducted in a temperature controlled water bath designed to maintain the temperature of the test solutions at 23 ± 1 °C. The test area had a photoperiod of 16 hours of light and 8 hours of darkness, with a light intensity range of 30 to 70 footcandles. Lighting was provided by Sylvania Growlux® and Cool White® fluorescent bulbs.

The overlying water was renewed by adding two volume additions (350 mL total) per day, with a calibrated water-delivery system (Zumwalt *et al.*, 1994). Midge larvae were fed daily. The amount fed ranged between 0.5 mL and 1.5 mL of a suspension of finely ground Tetramin® flaked fish food (4.0 mg/mL), per test vessel, based on the amount of food

collected on the sediment surface. The midge larvae were not fed on Day 8 since sufficient food was available on the sediment surface in the test vessels.

Total hardness, alkalinity, specific conductance, and ammonia were determined at test initiation and test termination in the overlying water from a composite sample from all replicates. The composite sample was taken form 1 to 2 cm from the sediment surface using a pipet. Dissolved oxygen, pH, and temperature were measured in all replicate vessels at test initiation and test termination. Dissolved oxygen, pH, and temperature were monitored daily in at least one alternating replicate during the course of the study. Temperature extremes were recorded daily from readings of a minimum/maximum thermometer place in the water bath. At test initiation and at each subsequent 24-hour interval, biological observations and the physical characteristics of the test solutions were observed and recorded.

Survival was determined at test termination by sieving the sediment from each replicate test vessel to remove the midges for observation. Midge larvae weight was determined by drying the surviving test organisms at 60 ° C for 24-hours then weighing them on a calibrated analytical balance.

2.4.4 Deviations to the Test Method

No deviations to the test methods occurred during this study.

2.5 Subchronic Toxicity Test with Amphipods

2.5.1 Test Method and Conduct

Test organisms were placed in beakers containing the sediment and clean laboratory water on 25 September 1995 and were incubated under standard conditions until 5 October 1995 (10 days). After the exposure, the surviving organisms were counted. Sediment toxicity was estimated by comparing the response of exposed organisms in the test sediment with the reference control sediment. Procedures used in the acute toxicity test with amphipod followed those described in the Springborn test method entitled "Static-Renewal

Acute Toxicity Test with *Hyallela azteca*" to Meet U.S. EPA Guidelines, Springborn Laboratories Test Method #SED-Ha-121. The procedures described in this test method meet the standard procedures described in the *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (U.S. EPA, 1994). A copy of the test method is an attachment to this report.

2.5.2 Test Organism

The test organisms, *Hyalella azteca*, used in this study were obtained from Environmental Consulting and Testing. The approximately 1000 amphipods, 7 days old were received on 19 September 1995 and assigned SLI lot number 95A79. The test population was split in two groups of 500 and held for 6 days under static conditions in 9.5-liter aquaria containing 6 L of water. Amphipods were held in fortified laboratory well water and fed a suspension of yeast, cerphyl and trout food suspension (YCT) and supplemented with flake fish food, daily. Temperature was maintained at 23 ± 1°C. The holding area received a regulated photoperiod of 16 hours of light and 8 hours of darkness. Light intensity of 30 to 100 footcandles was provided at the culture solutions' surface by Durotest Vitalite fluorescent bulbs. Amphipods used to initiate the exposure were 13 days old.

2.5.3 Test Procedures

Eight replicate test vessels (300-mL glass beakers) were maintained for each sediment sample and control. Each vessel contained 100 mL (wet weight) of sediment and 175 mL of laboratory water. The resultant sediment layer in each test vessel was 2 cm deep. Each sediment was tested as 100% with no dilutions. The test systems with sediment and water were allowed to sit overnight before introducing the test organisms. The test was initiated when ten amphipods were introduced to each test vessel. Aeration was provided to each test vessel when dissolved oxygen dropped below 40% of saturation.

The test was conducted in a temperature controlled water bath designed to maintain the temperature of the test solutions at 23 ± 1 °C. The test area had a photoperiod of 16

hours of light and 8 hours of darkness, with a light intensity range of 30 to 70 footcandles. Lighting was provided by Sylvania Growlux® and Cool White® fluorescent bulbs.

The overlying water was renewed by adding two volume additions (350 mL total) per day, with a calibrated water-delivery system (Zumwalt *et al.*, 1994). The amphipods were fed daily. They were fed 1.0 mL of YCT per test vessel, except on Day 0 when they were fed a 1.5 mL suspension of trout chow, per test vessel.

Total hardness, alkalinity, specific conductance, and ammonia were determined at test initiation and test termination in the overlying water form a composite sample from all replicates. The composite sample was taken form 1 to 2 cm from the sediment surface using a pipet. Dissolved oxygen and temperature were measured in all replicate vessels at test initiation and test termination. Dissolved oxygen and temperature were monitored daily in at least one alternating replicate during the course of the study. Temperature extremes were recorded daily from readings of a minimum/maximum thermometer place in the water bath. At test initiation and at each subsequent 24-hour interval, biological observations and the physical characteristics of the test solutions were observed and recorded.

Survival was determined at test termination by sieving the sediment from each replicate test vessel to remove the amphipods for observation. The amphipod weights were determined by drying the surviving test organisms at 60 ° C for 24-hours then weighing them on analytical balance.

2.5.4 Deviations to the Test Method

The following deviations from the test method occurred in this study.

1. Fortified well water was used for the overlying water rather than well water as stated in the test method. We do not believe this deviation adversely affected the results of this study.

2. There was 64% survival of organisms exposed to the control sediment. This was below the 80% acceptance criteria. This deviation alters statistical analysis of the data, however some inferences about sediment toxicity can still be drawn. These inferences are discussed further in the results section of the report.

2.6 Bioaccumulation Tests with Oligochaetes

2.6.1 Study Method and Conduct

Test organisms were placed in aquaria containing the sediment and laboratory water and were incubated under standard conditions for 28 days. After exposure, the surviving Oligochaetes from each sediment sample and control were placed in 1 liter glass beakers containing approximately 900 mL of laboratory water for a period of 24 hours. This 24 hour period allowed the test organisms to eliminate their gut contents. Following the 24 hour elimination period, all Oligochaetes from each sediment sample and control were frozen then shipped on dry ice for analyses. Procedures used in the bioaccumulation test with oligochaetes followed those described in the Springborn Laboratories test method entitled "Bioaccumulation Test with Oligochaete *Lumbriculus variegatus*", Springborn Laboratories Test Method #SED-Lv-160. The procedures described in this test method follow methodology presented in the *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (U.S. EPA, 1994).

2.6.2 Test Organism

Lumbriculus variegatus were obtained from cultures maintained at Springborn. Oligochaetes were cultured in 57-liter glass aquaria containing approximately 40 liters of laboratory water and a 3 to 5 cm layer of artificial substrate, which was maintained at a temperature of 22 ± 2 °C. The artificial substrate consists of shredded unbleached paper towel, conditioned in laboratory water. The cultures were maintained under flow through conditions. The culture area received a regulated photoperiod of 16 hours of light and 8 hours of darkness. Light at an intensity of 30 to 100 footcandles was provided at the culture solutions' surface by Durotest Vitalite® fluorescent bulbs. The overlying water was

continuously aerated with oil free air. Each culture aquaria was fed, three times per week, a 10 mL suspension of salmon starter (5 mg/mL).

2.6.3 Test Procedures

The test vessels used during this test were 9.5-L aquaria. Three replicate aquaria were maintained for each sediment sample and a control. Each aquaria contained 1 liter of sediment and 4 liters of overlying laboratory water. The resultant sediment layer in each test vessel was 3 cm deep. Each sediment sample was tested as 100% (no dilutions). The test system with sediment and water were allowed to sit overnight before introducing the test organisms. The test was initiated on 19 September 1995, when 100 oligochaetes were introduced to each test aquaria. Aeration was provided to each test vessel throughout the exposure period. The exposure period ended after 28 days on 17 October 1995.

The test was conducted in a temperature controlled water bath designed to maintain the temperature of the test solutions at 23 ± 1 °C. The test area had a photoperiod of 16 hours of light and 8 hours of darkness, with a light intensity range of 30 to 100 footcandles. Lighting was provided by Durotest Vitalite® fluorescent bulbs.

Renewal of the overlying water in each replicate aquaria was performed weekly by carefully siphoning off 75% (approximately 3 liters) of the existing overlying water and gently replacing it with fresh site water. Oligochaetes were not fed during the 28 day exposure. Sufficient organic matter existed (>1.25% organic carbon) in each sample to eliminate feeding during the 28 day study.

At test initiation and at each subsequent 24-hour interval, biological observations and the physical characteristics of the test solutions were observed and recorded. The dissolved oxygen concentration, pH and temperature were measured daily in alternating replicate test aquaria. At test initiation and weekly thereafter, dissolved oxygen, pH and temperature were measured in all replicate aquaria of each test sediment and control. At test initiation and

weekly thereafter until test termination, total hardness, total alkalinity, specific conductivity, and ammonia concentration of overlying water from each test sample and control were measured in alternating replicates.

Surviving biomass was determined at test termination. The oligochaetes were collected by sieving the sediment from each replicate aquaria. Following a 24 hour gut elimination period the oligochaetes were frozen awaiting shipping to the analytical laboratory.

2.6.4 Chemical Analysis of the Xenobiotic(s)

The three exposure oligochaete samples and one control oligochaete sample were frozen and shipped on dry ice to ESE, Inc. on 19 October 1995 via Federal Express overnight service. The chemical analysis of the samples was arranged by ABB Environmental Services.

2.6.5 Deviations to the Test Method

The tissue samples were delivered in a 48-hr period, rather than the 24-hr period stated in the test method. The delay in the delivery was due to a faulty fuel line on a Federal Express jet. The samples were still partially frozen upon arrival at ESE, Inc. We do not believe this deviations adversely affected the results of this study.

2.7 Statistical Analysis

The mean survival and growth of midge larvae and amphipods and total biomass of the oligochaetes from each test sediment and reference control sample were tested for normality and homogeneity of variance using Shapiro-Wilks Test or Chi-Square Test. Since the data passed the two qualifying tests, Dunnett's Test was used to evaluate the results of the mean survival and growth of each test sample for significant adverse effects.

3.0 RESULTS AND DISCUSSION

3.1 Toxicity Tests

3.1.1 *Chironomus tentans*

A summary of the water quality characteristics of overlying water during the 10-day subchronic tests with *Chironomus tentans* is presented in Table 1. A summary of the biological results from the screening tests with *C. tentans* is presented in Table 2. The midge survival and growth in the laboratory control sample exceeded acceptable test criteria. There were no statistically significant midge survival and growth effects observed in any of the study site samples, compared to the laboratory control data. However, samples ZWD-95-06X, 57D-95-04X, and 57D-95-05X had midge survival of less than 70%.

Comparison of study site samples with a reference sample (57D-95-08X) showed that no significant survival effects were observed in any samples. Midge growth in sample 57D-95-04X was significantly less than the growth observed in the reference sample. All other samples showed no significant growth effects when compared to the reference sample.

3.1.2 *Hyalella azteca*

A summary of the water quality characteristics of overlying water during the 10-day acute tests with *Hyalella azteca* is presented in Table 3. A summary of the biological results from the screening tests with *H. azteca* is presented in Table 4. The *H. azteca* survival in the laboratory control sample did not meet the acceptable test criteria. The cause of this failure to meet the acceptable criteria is not known. Three of the study site samples had amphipod survival which exceed 80%. All of the organisms used in this study came from the same source and were impartially distributed among the nine study site samples and the laboratory control.

Statistical comparisons of the study site samples against the laboratory control were conducted even though the control did not meet the survival acceptance criteria. Amphipod

survival in sample ZWD-95-06X was significantly less than the control survival. Sample ZWD-95-06X also had the lowest midge survival (Table 2).

Comparison of study site samples with a reference sample (57D-95-08X) showed that amphipod survival in samples ZWD-95-02X and ZWD-95-06X was significantly reduced. No significant growth effects were observed when compared with the reference sample.

3.2 Bioaccumulation Study

A summary of the water quality characteristics of overlying water during the 28-day exposure with *Lumbriculus variegatus* is presented in Table 5. The mean oligochaete biomass from each sample at the termination is presented in Table 6. Results of the chemical analysis of the oligochaete tissue and sediment are presented in Table 7.

Tetrachloro-m-xylene and decachlorobiphenyl were found in the three study site tissue samples and the laboratory control. Aldrin was found in two of the study site tissue samples (57D-95-08X and 57D-95-06X) and the laboratory control. None of the analities found in the oligochaete tissue were measured in the sediments from the study site. There was an unusual correlation between the concentration of the three analities found in the oligochaete tissue samples and the order of the four tissue samples. The control tissue had the highest concentration of all three analities, sample 57D-95-08X had the second highest concentration of all three analities, sample 57D-95-06X had the third highest concentration of all three analities and sample 57D-95-05X had the lowest concentration of all three analities. This trend suggests that either the quantification limits of each compound for the small mass of tissue were unreliable, or that there was some sort of systematic sample contamination. In either event, since the three analities were not found in the sediment from the study site, the tissue concentrations appear to be artifactual.

4.0 REFERENCES

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5.0 TABLES

Table 1. **Water quality parameters (dissolved oxygen, pH, temperature, total alkalinity, total hardness, specific conductivity) measured in the overlying water during the 10-day subchronic toxicity tests with *Chironomus tentans*.**

Sample Identification	Dissolved Oxygen (mg/L)		pH		Ammonia (mg/L as N)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control	8.1-8.3	4.2-4.8	6.8	6.3-6.6	0.58	0.63
ZWD-95-02X	8.7	3.9-7.2	7.0-7.1	6.5-6.6	0.21	0.80
ZWD-95-03X	8.6-8.7	4.6-7.3	7.0	6.4-6.5	0.0	0.85
ZWD-95-06X	8.7-8.8	5.6-7.3	7.1	6.1-6.7	0.0	0.87
57D-95-04X	8.0-8.3	3.1-6.8	6.8-6.9	6.4-6.5	0.16	0.87
57D-95-05X	7.4-7.6	5.3-6.9	6.7-6.8	6.4-6.5	0.08	0.70
57D-95-06X	7.9-8.3	5.8-7.2	6.8-6.9	6.4-6.5	0.16	0.45
57D-95-07X	7.5-7.9	1.4-6.9	7.0	6.1-6.5	0.28	0.72
57D-95-08X	8.0-8.2	4.6-7.1	6.9-7.0	6.4-6.5	0.34	0.79
57D-95-10X	7.5-7.9	4.4-7.4	6.8-6.9	6.5	0.30	0.68

Sample Identification	Alkalinity (mg/L as $CaCO_3$)		Hardness (mg/L as $CaCO_3$)		Conductivity (µmhos/cm)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control	20	20	44	32	160	110
ZWD-95-02X	22	30	44	40	160	120
ZWD-95-03X	22	26	40	36	170	110
ZWD-95-06X	20	32	40	40	170	120
57D-95-04X	20	22	36	32	160	110
57D-95-05X	22	28	40	40	170	120
57D-95-06X	20	18	44	40	160	110
57D-95-07X	24	26	44	48	170	130
57D-95-08X	24	24	44	40	160	120
57D-95-10X	22	26	44	36	170	120

Table 2. Survival and average dry weights of *Chironomus tentans* at the termination of the 10-day subchronic toxicity tests.

Sample Identification	Mean Percent Survival (Standard Deviation)	Mean Dry Weight in mg (Standard Deviation)
Control	74(19)	1.70(0.32)
ZWD-95-02X	75(15)	2.24(0.85)
ZWD-95-03X	88(14)	2.94(0.67)
ZWD-95-06X	60(19)	2.41(0.93)
57D-95-04X	65(29)	1.36(0.30)[a]
57D-95-05X	64(29)	2.00(0.48)
57D-95-06X	90(8)	1.80(0.19)
57D-95-07X	71(24)	2.27(0.67)
57D-95-08X	84(12)	1.81(0.30)
57D-95-10X	83(12)	1.75(0.33)

[a] Midge growth in this sample was significantly less than the reference sample (57D-95-08X).

Table 3. Water quality parameters (dissolved oxygen, pH, temperature, total alkalinity, total hardness, specific conductivity) measured in the overlying water during the 10-day acute toxicity tests with *Hyalella azteca*.

Sample Identification	Dissolved Oxygen (mg/L)		pH		Ammonia (mg/L as N)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control	6.8-7.1	5.9-6.2	7.3-7.4	7.5-7.7	0.72	0.36
ZWD-95-02X	7.4-7.8	5.5-6.4	7.6-7.8	7.4-7.7	0.28	0.41
ZWD-95-03X	7.5-7.7	5.4-7.8	7.6-7.7	7.5-7.8	0.0	0.21
ZWD-95-06X	7.2-7.5	5.0-6.4	7.6-7.7	7.2-7.6	0.02	0.33
57D-95-04X	7.5-7.8	5.6-6.5	7.5-7.6	7.4-7.7	0.13	0.10
57D-95-05X	6.2-6.6	4.7-6.0	7.3-7.4	7.4-7.6	0.07	0.23
57D-95-06X	6.5-6.6	5.5-6.2	7.3-7.4	7.3-7.7	0.25	0.32
57D-95-07X	6.1-6.6	4.8-6.2	7.6-7.7	7.4-7.7	0.32	0.20
57D-95-08X	6.3-6.5	5.4-6.5	7.5	7.4-7.8	0.42	0.38
57D-95-10X	6.5-7.7	5.1-6.3	7.4-7.6	7.6-7.8	0.28	0.21

Sample Identification	Alkalinity (mg/L as ($CaCO_3$))		Hardness (mg/L as ($CaCO_3$))		Conductivity (µmhos/cm)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control	98	112	156	164	500	500
ZWD-95-02X	124	114	168	176	500	500
ZWD-95-03X	110	112	168	172	450	500
ZWD-95-06X	116	112	168	172	500	500
57D-95-04X	104	106	160	160	500	500
57D-95-05X	106	124	164	180	500	500
57D-95-06X	102	106	156	168	500	500
57D-95-07X	112	120	172	172	500	500
57D-95-08X	116	116	168	172	500	500
57D-95-10X	114	112	168	172	500	500

Table 4. **Survival of *Hyalella azteca* at the termination of the 10-day acute toxicity tests.**

Sample Identification	Mean Percent Survival (Standard Deviation)	Mean Dry Weight in mg (Standard Deviation)
Control	64(18)[a]	0.10(0.05)
ZWD-95-02X	55(24)[b]	0.15(0.07)
ZWD-95-03X	66(18)	0.10(0.05)
ZWD-95-06X	36(23)[b, c]	0.11(0.07)
57D-95-04X	83(7)	0.08(0.01)
57D-95-05X	70(19)	0.16(0.05)
57D-95-06X	84(9)	0.08(0.03)
57D-95-07X	74(7)	0.11(0.04)
57D-95-08X	80(21)	0.10(0.03)
57D-95-10X	71(18)	0.11(0.06)

[a] The control survival did not meet the acceptance criteria of 80%.

[b] Amphipod survival in this sample was significantly less than the reference sample (57D-95-08X).

[c] Amphipod survival in this sample was significantly less than the control.

Table 5. **Water quality parameters (dissolved oxygen, pH, temperature, total alkalinity, total hardness, specific conductivity) measured in the overlying water during the 28-day exposure with *Lumbriculus variegatus*.**

Sample Identification	Dissolved Oxygen (mg/L)	pH	Ammonia (mg/L as N)
	Day 0-28	Day 0-28	Day 0-28
Control	6.4-8.6	6.5-7.2	0.26-0.71
57D-95-05X	6.4-8.1	6.9-7.6	0.47-0.79
57D-95-06X	6.9-8.2	7.1-7.5	0.50-0.92
57D-95-08X	6.9-8.3	7.2-7.6	0.48-0.68

Sample Identification	Alkalinity (mg/L as $CaCO_3$)	Hardness (mg/L as $CaCO_3$)	Conductivity (µmhos/cm)
	Day 0-28	Day 0-28	Day 0-28
Control	16-38	24-56	90-220
57D-95-05X	22-82	32-88	110-300
57D-95-06X	20-63	40-76	140-250
57D-95-08X	24-50	44-80	150-250

Table 6. Mean biomass per aquarium of *Lumbriculus variegatus* at the termination of the 28-day exposure.

Sample Identification	Mean Biomass (g)/Aquarium (Standard Deviation)
Control	1.37(0.09)
57D-95-05X	1.43(0.11)
57D-95-06X	1.52(0.41)
57D-95-08X	1.18(0.25)

Table 7. Concentration of analities measured in sediment and tissue of *Lumbriculus variegatus* after the 28-day exposure.

Sample Number	Sample Type	Concentration (µg/kg) Wet Weight		
		Aldrin	Tetrachloro-m-xylene	Decachlorobipheny l
Control	tissue	39.7	2850	3380
57D-95-08X	tissue	21.6	919	1130
57D-95-06X	tissue	16.6	751	926
57D-95-05X	tissue	<6.67	454	558
Control	sediment	NA	NA	NA
57D-95-08X	sediment	ND	ND	ND
57D-95-06X	sediment	ND	ND	ND
57D-95-05X	sediment	ND	ND	ND

NA = not analyzed
ND = not detected

6.0 SIGNATURES AND APPROVAL

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